

Program & Abstracts

Joint Congress 2017

ISFRI • IAFR

6th Congress of the International Society of Forensic Radiology and Imaging
12th Anniversary Meeting of the International Association of Forensic Radiographers

11-13 May • www.ISFRI2017.com
University of Southern Denmark • Odense, Denmark



ISFRI | International Society of
Forensic Radiology and Imaging

SDU

Dear Participants,

It is our great pleasure on behalf of the scientific committee to welcome you to the joined 6th annual meeting of the International Society for Forensic Radiology and Imaging (ISFRI) and the 12th Anniversary Meeting of the International Association of Forensic Radiographers (IAFR), in Odense in Denmark May 11th – 13th 2017.

Forensic imaging plays an increasingly important role in forensic science and constitutes a rapidly developing research area. The joint ISFRI and IAFR annual meeting presents an opportunity to hear about the latest developments in this exciting new field and meet with colleges from all over the world.

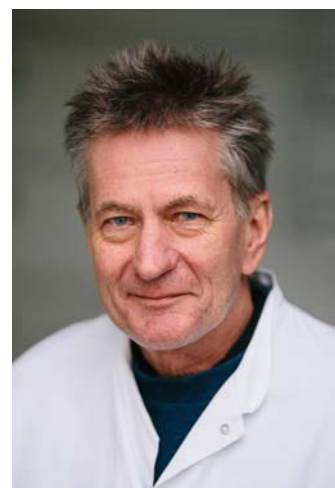
The meeting is hosted by the Department of Forensic Medicine at the University of Southern Denmark in close collaboration with the Departments of Forensic Medicine at the Universities of Copenhagen and Aarhus.

The University of Southern Denmark is the third largest university in Denmark and has a close cooperation with Odense University Hospital. This cooperation will be further strengthened with the opening of a new super hospital in 2022 that will be linked to the university campus by a new-built faculty of medical science.

Odense is a peaceful and beautiful city situated on the island of Funen in the centre of Denmark and only 1.5 hours train ride from Copenhagen Airport. The city is named after Odin, the Norse god of war, poetry and wisdom – a perfect patron for a cultural and historical hotspot.

As always the spirit of the meeting is one of collegiality and respect. The joined annual meeting of the ISFRI and IAFR offers the participants the chance to meet old and new friends, to strengthen bonds and to start collaborations.

Best regards,
Professor Peter Mygind Leth, MD. DMSc. Chair ISFRI
On behalf of the scientific committee



Content

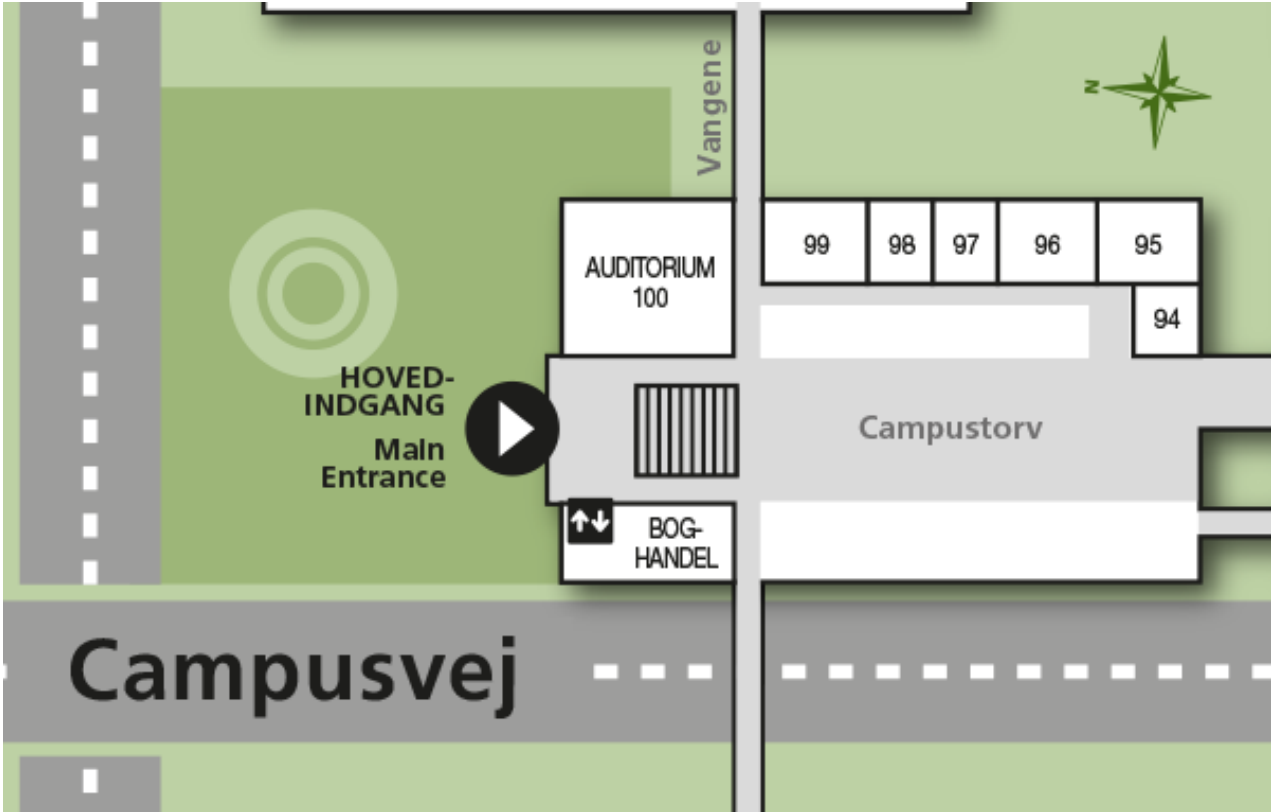
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Organizing Committee

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Venue, Floor Plan

SDU - University of Southern Denmark, Campusvej 55, 5230 Odense M



Daily Programs

Wednesday May 10

Pre-Congress meetings

- 15.30 – 17.00 ISFRI board meeting
Library, Department of Forensic Medicine, J.B. Winsløws Vej 17A, 5000 Odense C
(closed meeting, by invite only)
- 18.00 – 20.00 Reception at Odense City Hall

Thursday May 11, 2017

- 08:00 Registration, welcome & coffee
- 09:00 **Opening by Professor Peter Mygind Leth, University of Southern Denmark**
- 09:15 – 11.00 **Plenary Session: Forensic imaging in times of terror**
Chairmen professor Guy Rutty and forensic radiologist Chris O'Donnell
- 09:15 Hard data in the face of conflicting narrative
Forensic pathologist dr. *Alon Krispin*. Director of Forensic Imaging Service at the National Center of Forensic Medicine (ICFM), Israel
- 10:00 Forensic imaging of the victims from Malaysian Airline Flight MH17
Professor *Paul Hofman*, Department of Radiology, Maastricht University Medical Center
- 10:45 Discussion
- 11:00 Coffee break and posters
- 11:45 – 13.00 **Scientific session I** (6 lectures of 10 minutes)
Chairmen associate professor Peter Thiis Knudsen and forensic anthropologist Chiara Villa
- 13:00 – 14.00 Lunch
- 14:00 – 15.30 **Plenary session: Forensic imaging in times of terror**
Chairmen professor Guillaume Gorincour and professor Rick R. van Rijn
- 14:00 - 14:30 Identification of suspects from video-surveillance cameras
Forensic Anthropologist *Peter K. Larsen*, University of Copenhagen, Unit of Biological Anthropology
- 14:30 - 15:30 The use of forensic radiology for the investigation of the terror attack at Utøy in Norway July 22nd 2011.
Senior consultant in forensic pathology and clinical forensic medicine *Arne Stray-Pedersen*, Department of Forensic Medicine, University of Oslo

15:30	Discussion
15:45	Coffee break and posters
16:30	End of day 1
19:00 - 21:00	Casual Dinner at Dept. of Anthropology (ADBOU)

Friday May 12, 2017

08:00	Registration, welcome & coffee
08:30 – 10.30	Plenary session: Specialized imaging modalities <i>Chairmen professor Jesper Boldsen and professor Lene Boel</i>
08:30	MicroCT Professor <i>Sarah Hainsworth</i> , Director of ASDEC/Professor of Materials and Forensic Engineering, Department of Engineering, University of Leicester, UK
09:15	Discussion
09:30	Contrast enhanced micro-CT; potential forensic applications Dr <i>Robert Stephenson</i> PhD, Marie Curie research fellow, Department of Clinical Medicine, University of Aarhus
10:15	Discussion
10:30	Coffee break and posters
11:15 – 13.00	Scientific Session II (6 lectures of 10 minutes) <i>Chairmen forensic radiologist Thomas Ruder & professor Jørgen Lange Thomsen</i>
12:15	Gil Brogdon Honorary lecture Imaging in archaeology Professor <i>Niels Lynnerup</i> , anthropological laboratory, Department of forensic Medicine, University of Copenhagen.
13:00	Lunch
14:00	ISFRI workshops: (all are welcome) <ol style="list-style-type: none"> 1. DVI (Room O98) Moderator: <i>Guy Rutty</i> 2. Education (Room O97) Moderator: <i>Guillaume Gorincour</i> 3. Image acquisition (Room 96) Moderator: <i>Natalie Adolphi</i> 4. Anthropology (Room O94) Moderator: <i>Alison Brough</i>
15:00	Coffee break and posters

15:30 – 16.45	Scientific session III (6 lectures of 10 minutes) <i>Chairmen forensic radiologist Lise Loft Nagel and professor Lars Oesterhelweg</i>
16:45	6 th General assembly of the ISFRI
17:30	End of day 2
14:00 – 16:30	Program B: Parallel Program (Room O99) 12th Annual Meeting of International Association of Forensic Radiographers Moderators: M. Viner & J. Kroll
14:00 – 14:10	Welcome by IAFR Chair / Vice-Chair
14:10 – 14:45	Bone Age Guidelines <i>E Doyle</i>
14:45 – 15:15	Anthropology - Radiology Assessment of Juvenile remains - MDCT or Digital Radiography? <i>Amy- Lee Brookes</i>
15:15 – 16:00	Age estimation in forensic osteology <i>Jesper Boldsen, ADBOU, Dept. of Anthropology, University of Southern Denmark</i>
20:00	Annual dinner at Hindsgavl Castle

Saturday May 13, 2017

08:00	Registration, welcome & coffee
08:30 – 11.00	Plenary session <i>Chairmen professor Krzysztof Wozniak and professor Niels Lynnerup</i>
08:30	The diagnostic accuracy of the triad in “shaken baby syndrome”. Is the evidence massive and robust? <i>Professor Anders Eriksson and professor Anders Persson, Unit of Forensic Medicine, Umeå University and Center for Medical Image Science and Visualization (CMIV), Linköping university.</i>
09:30 – 09:45	Discussion
09:45	Coffee break and posters
10:15	Musculoskeletal Ultrasound with Reference to Potential use in Forensics, chief physician <i>Michel Bach Hellfritzsch, Aarhus University Hospital</i>
10.45	Discussion
11.00	Coffee break and posters

- 11:30 – 13:00 **Scientific session IV** (6 lectures of 10 minutes)
Chairmen professor Michael Thali and associate professor Birgitte Schmidt Astrup
- 12:30 – 13:15 3D Crime Scene reconstruction in bombings
 Senior lecturer *Chiara Villa*, University of Copenhagen and deputy chief forensic pathologist *Peter Thiis Knudsen*, University of Southern Denmark
- 13.15 Closing ceremony & Call for ISFRI 2018 Board
- 13:45 End of ISFRI 2017**
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- 10:45 – 12:45 **Program B: Parallel Program**
12th Annual Meeting of International Association of Forensic Radiographers
 Moderator: *E. Doyle*
- 10:45 - 11:00 Management of a terrorist attack situation
 Paris November 2015
Philippe Gerson, Hôtel Dieu Paris Hospital, Paris, France
- 11:00 - 11:45 Terrorist Incidents in London 1990–2005
Mark Viner, Forensic Institute, Cranfield University, U.K.
- 11:45 - 12:15 Integrating MDCT into the DVI Process
Jeroen Kroll, UMC Maastricht, Netherlands
- 12:15 - 12:45 Forensic Radiography “Down Under”
Lisa Detleif-Nielson, Dept. of Forensic Medicine, Enmore, Australia

Social Program

Wednesday 10th May, 2017

Welcome reception at Odense City Hall; 18.00 – 20.00

The City of Odense is pleased to invite all delegates to a reception at the beautiful and historic City Hall at the end of the first day of the Congress.

Odense City Hall is located in the centre of the old part of the city, surrounded by Sct. Knuds Plads, Albani Torv and Vestergade. The City Hall consists of two different parts, an old and a new one. The part facing Flakhaven was built in 1881-83 in an Italian-Gothic style. The new part is from 1955 and has been added to the old building in a very attractive way.



Thursday 11th May, 2017

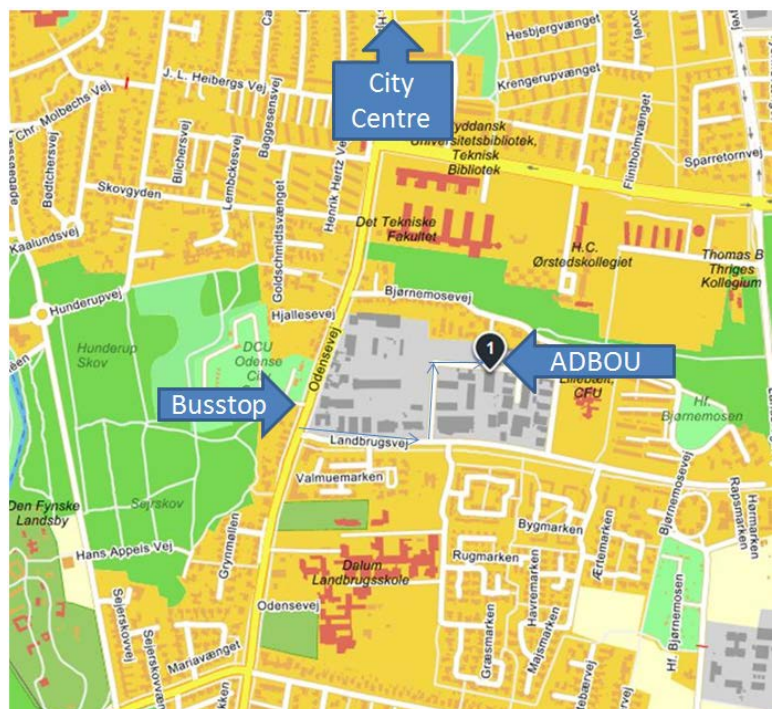
Casual dinner at ADBOU from 19.00-21.00

ADBOU is the Unit of Anthropology at the Department of Forensic Medicine, University of Southern Denmark in Odense (www.adbou.dk). ADBOU curates the remains of more than 15,000 skeletons excavated from Viking Age, Medieval and Post Medieval cemeteries. This event is a relaxed, casual evening. Typical Danish hot sausages, known as *Polser*, will be served from a typical Danish *polsevogn* (literally "sausage wagon") together with draft beer from the small, but popular local Refsvindinge brewery. Some of the skeletons will be on display (please don't spill beer on the old bones!) and the units CT-scanner will be demonstrated.



How to get to ADBOU:

5 min by bus from the city centre. Take bus No. 60-62, direction 'Højby'. Busstop 'Odense City Camp - Landbrugsvej'. 2 min walk from busstop to ADBOU (1), Lucernemarken 20.



Friday 12th May, 2017

Congress Dinner at Hindsgavl Castle, Middelfart, 20:00 – 23.00

Venue: Hindsgavl, Middelfart. (30 min from Odense)

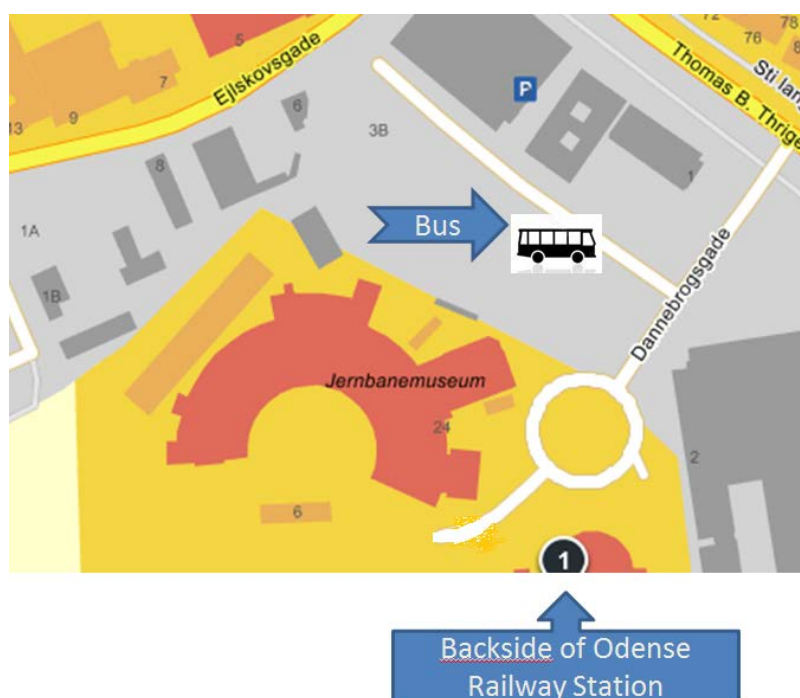
Departure by bus from the city centre at 19:00. Go to Odense Railway Station, and find **tour bus parking** on the backside of the building (towards the Railway Museum, Address: Dannebrogsgade). Bus returns to Odense city centre at 23.15.

Join your colleagues for the official congress dinner at the beautiful Hindsgavl Castle where you will experience a unique combination of a classic castle, a modern hotel and nuanced Danish cuisine. This charming waterfront castle overlooks the picturesque Fænø Sound and Little Belt Strait, in Middelfart.



It is hard not to be overwhelmed when walking in and around Hindsgavl Castle situated at the Little Belt coast of Funen. Already when driving down the castle avenue you get the sense of entering another world and another time.

Even *Hans Christian Andersen* found that the view was the most beautiful in Funen and he did not exaggerate: the garden and the park are outstanding with the pavillions, the streams, the ponds and the Little Belt in the background, and the nearest neighbour is the deer park *Hindsgavl Dyrehave* with red deer and fallow deer.



Oral Presentations

Thursday May 11, 2017 11:45		
1	O'Donnell, Chris chris.odonnell@vifm.org	Can torture be inferred on the basis of PMCT interpretation?
2	Fujimoto, Hideko kyoto.f.o@gmail.com	Development of mechanical screening system for personal identification
3	Woźniak, Krzysztof et al mpwoznia@cyf-kr.edu.pl	Postmortem imaging as a standard in evaluation of sharp force trauma – overview of recent cases
4	Sieberth, Till Lars.Ebert@irm.uzh.ch	Interactive Crime Scene Visualisation – The Forensic Holodeck
5	Heimer, Jakob Jakob.Heimer@irm.uzh.ch	Antemortem identification by fusion of MR and CT
6	Schweitzer, Wolf et al Wolf.Schweitzer@irm.uzh.ch	Visualization strategies in forensic imaging & Virtopsy: recommendations based on semiotic analysis
Friday May 12, 2017 11:15		
7	Pelletti, Guido guidopelletti@gmail.com	Qualitative and quantitative study of false starts on bones through micro-CT. Preliminary results.
8	Borowska-Solonyanko, Aleksandra et al borowska.solonyanko@gmail.com	Occipital condylar fractures – rare or unrecognized injury during traditional autopsy?
9	Zoelch, Niklaus et al Niklaus.Zoelch@irm.uzh.ch	Non-invasive ethanol quantification in human bodies by in situ magnetic resonance spectroscopy
10	Webb, Bridgette Bridgette.Webb@cfi.lbg.ac.at	Developing an approach to post-mortem MR angiography (PMMRA): Investigation of vascular retention of perfusates in <i>ex situ</i> porcine hearts
11	De Tobel, Jannick jannick.detobel@gmail.com	The influence of motion artefacts on magnetic resonance imaging of the clavicles for age estimation
12	Gascho, Dominic et al Thomas.Ruder@irm.uzh.ch	Estimation of body weight from effective radiation dose of whole-body CT

Friday May 12, 2017 15:30		
13	Boglárka, Marcsa et al toro.klara@med.semmelweis-univ.hu	Forensic Evaluation of Crania Recovered from Archaeological Excavations Exhibiting Evidence of Sharp Force Trauma
14	Rutty, Guy et al gnr3@leicester.ac.uk	Ventilated Post Mortem Computed Tomography (VPMCT). Does it really make a diagnostic difference?
15	Robinson, C et al claire.robinson@uhl-tr.nhs.uk	Pulmonary Thromboembolism – improving the diagnosis on post-mortem CT (PMCT)
16	Bolster, Ferdia et al bdaly@umm.edu	Accuracy of PMCT with Death Investigation and Toxicology Reports for Cause and Manner of Death as Determined by Conventional Autopsy
17	Dedouit, Fabrice Fabrice.Dedouit@chuv.ch	Death due to aortic dissection or rupture – comparison of postmortem CT (PMCT) and multi-phase PMCT angiography (MPMCTA), against autopsy.
18	Rutty, Guy et al gnr3@leicester.ac.uk	The Leicester Post Graduate Post Mortem Radiology Training Courses; our experience so far.
Saturday May 13, 2017 11:30		
19	Pedersen, Dorthe Dangvard et al dopedersen@health.sdu.dk	A possible case of medieval child abuse
20	Stoll, Alexander a.stoll@surrey.ac.uk	The Use of Diagnostic Imaging in Forensic Veterinary Pathology
21	Ebert, Lars C Lars.Ebert@irm.uzh.ch	The use of deep learning in forensic medicine – a feasibility study
22	Jotterand, Morgane Morgane.Jotterand@chuv.ch	New formula for cardiothoracic ratio for the diagnostic of cardiomegaly on post-mortem CT
23	Urschler, Martin urschler@icg.tu-graz.ac.at	Automated Multi-Factorial Age Estimation from Skeletal and Dental MRI Volumes based on Deep Learning

Poster Presentations

No.	Writer	
1	Raquel, Vilarino et al Raquel.Vilarino@hopitalvs.ch	MR Spectroscopy in traumatic death: preliminary results
2	Noor, Mohd et al mohdsuhani@yahoo.com	The value of Postmortem Computed Tomography (PMCT) in differentiating live birth from stillbirth
3	Lee, Heon et al acarad@naver.com	Basal subarachnoid hemorrhage following violence-related minor blunt trauma to the head: Evaluation of vascular injury with post-mortem CT angiography
4	Hideki, Hyodoh et al hyodohh@yahoo.co.jp	An experimental evaluation of intermittent breathing in the appearance of drowning lung on postmortem CT
5	Makino, Yohsuke et al ymakino-tyk@umin.ac.jp	Evaluation of cervical spinal injuries by post-mortem MRI with gradient echo sequences
6	Lundemose, Sissel sissel.lundemose@sund.ku.dk	Post-mortem Hippocampal Measurements in Mentally Ill Individuals
7	Matteo, Nioi et al al.chighine@gmail.com	Optical coherence tomography (OCT) study on reproducibility of corneal pachymetry map results after death
8	Gomez, Oscar et al ogomez@decsai.ugr.es	Soft Computing and Computer Vision for Comparative Radiography in Forensic Identification
9	Pizzirani, Margherita et al megpizzirani@gmail.com	Multi-phase postmortem CT angiography (MPMCTA): first experiences of the Forensic Radiology Unit in the University of Modena (Italy)
10	Pereyra, Jorge et al jorgepereyrafernandez@gmail.com	Conventional Radiology and its Significant contribution to Forensic Anthropology
11	Baldoni, F et al amorico.mariagrazia@policlinico.mo.it	Usefulness of PMCT in forensic pathology: our experience
12	Yoshida, Maiko et al maikichi0711@gmail.com	Pseudo Pneumatosis Intestinalis Sign; Postmortem CT depicted 'Thaenia saginata (Parasite)' in a young-Thai-man's intestine.
13	Baron, K. et al Katharina.Baron@cfi.lbg.ac.at	Fracture dating: Comparing accuracy between morphological and quantitative analyses of MR data
14	Noor, Mohd mohdsuhani@yahoo.com	Forensic radiology in the DVI operation for the Wang Kelian clandestine graves in Malaysia
15	Kobayashi, Tomoya t.kobayashi1001@gmail.com	Relationship between postmortem MR relaxation time and body temperature: Is scan parameter optimization necessary?
16	Beng Ong, Beng et al ongbb77@gmail.com	Diagnosis of venous air embolism with the use of post-mortem CT scan
17	Gascho, Dominic et al Dominic.Gascho@irm.uzh.ch	Postmortem CT findings of decedents with a short postmortem interval and excessive gas- and/or fluid-filled distension of the bowels

18	Decker, Summer et al sdecker@health.usf.edu	3D Printing Applications for Medicolegal Practice Purpose
19	Busch, Johannes et al johannes.busch@sund.ku.dk	Identifying suspects by matching hand photographs with video evidence
20	Chatzaraki, Vasiliki Vasiliki.Chatzaraki@irm.uzh.ch	Unexpected brain finding in pre-autopsy postmortem CT
21	Carballeira Álvarez, Ana et al aacarballeira@gmail.com	Value of un-enhanced post-mortem computed tomography in the detection of traumatic abdominal injuries
22	Tashiro, Kazuya k_tashiro0219@yahoo.co.jp	Relaxation time of the skeletal muscles in postmortem MR imaging of adult humans
23	Hindsø, Louise et al louise.hindsoe@sund.ku.dk	Epicardial adipose tissue estimation by computed tomography of eviscerated hearts – A forensic method study
24	Leipner, Anja et al Anja.Leipner@irm.uzh.ch	Reconstruction of reflective surfaces such as vehicle mirrors based on 3D scan data for visibility simulation
25	Robinson, C et al claire.robinson@uhl-tr.nhs.uk	Evaluating a new service using PMCT to replace autopsy in natural death
26	Fonseca-Pinto, Ana Carolina B. C. et al anacarol@usp.br	Comparison of computed tomography brain and soft tissue windows to evaluate frozen artifacts in the liver and gallbladder of animal cadavers
27	De Matteis, Maria maria.dematteis@icloud.com	Post-mortem CT in criminal disposal of homicide victims. A ten-year retrospective study in Padua
28	Adolphi, Natalie NAdolphi@salud.unm.edu	Non-invasive Temperature Determination by Post-Mortem MR
29	Schweitzer, Wolf et al Wolf.Schweitzer@irm.uzh.ch	Very Affordable Immersion Pump for Post Mortem CT Angiography in Forensic Pathology: First 10 Cases
30	Jeanson, Alizé Lacoste alize.lacoste.jeanson@gmail.com	Can we predict nutritional status from the skeleton? Inputs from forensic radiology.
31	Boel, Lene Warner Thorup et al lwb@forens.au.dk	Death from displacement of airway stents
32	Boel, Lene Warner Thorup et al lwb@forens.au.dk	Distribution of skull and facial fractures according to circumstances of death

Non-invasive Temperature Determination by Post-Mortem MR

Adolphi, Natalie; Martinez Barrera, Julio; Weisand, Jordan; Gerrard, Chandra

Center for Forensic Imaging, University of New Mexico School of Medicine

To determine which MR tissue parameters correlate strongly with temperature, but not post-mortem interval, such that these parameters may be useful for determining subject temperature non-invasively.

Using mammalian tissues from several species and a spin echo pulse sequence, T1 and T2 were measured as a function of A) temperature, PMI < 48 hours, and B) post-mortem interval (PMI), at constant temperature (4, 19, or 35 oC). Both the temperature- and PMI-dependence of the apparent diffusion coefficient (ADC) of brain tissue were also investigated.

After controlling for temperature, the ADC of brain tissue showed a robust dependence on temperature and no dependence on PMI over many days. In the body, the T1 values for cardiac muscle, skeletal muscle, and lung parenchyma showed the strongest dependence on temperature; however, of these, only the skeletal muscle T1 showed no PMI-dependence.

Measurements performed in this study, which accounted for both temperature and PMI, demonstrate that our previous report of a PMI-dependence of the ADC of brain tissue was incorrect.

The ADC of brain tissue and the T1 of skeletal muscle are good candidates for use as non-invasive thermometers, based on their strong temperature-dependence and minimal PMI-dependence.

Keywords: PMMR, non-invasive thermometer

Usefulness of PMCT in forensic pathology: our experience

Baldoni F.¹, Pizzirani M.², Proccichiani D.¹, Todaro R.³, Amorico M.G.¹, Vecchio S.², Santunione A.L.², Tata C.¹, Torricelli P.¹, Silingardi E.²

¹Department of Diagnostic and Clinical Medicine and Public Health, Section of Diagnostic Imaging, University of Modena and Reggio Emilia, Modena, Italy. ²Department of Diagnostic and Clinical Medicine and Public Health, Section of Legal Medicine, University of Modena and Reggio Emilia, Modena, Italy. ³Radiodiagnostic and Radiotherapy Unit, University Hospital "Policlinico-Vittorio Emanuele", Via Santa Sofia 78, Catania 95123, Italy.

To evaluate the usefulness of PMCT in assessing cause of death and its diagnostic aid to the forensic pathologist before conventional autopsy. Define the advantages and limitations of the technique.

From 2006-2016, 115 subjects, divided by different forensic type underwent CT. 103 of these were subjected to conventional autopsy, the remaining 12, victims crushed in the 2012 earthquake, were subjected only to TC. The study was performed with a 64-row CT-unit (GE Milwaukee USA) from head to foot, using the following scan parameters: slice thickness 1 mm and interval of reconstruction 1 mm. 2D and 3D reconstructions were performed on all. The reporting was done by two radiologists with specific experience in the field.

We compared autopsy findings with those of PMCT by highlighting findings of forensic interest. They were divided into: basic, very relevant, useful, not important.

Compared to conventional / virtual autopsy, resulted significantly useful in skeletal findings (98%), and not essential but important in the remaining areas.

PMCT carried out before traditional autopsy greatly facilitates the work of the forensic pathologist in preliminarily identifying the most significant findings, but does not entirely replace traditional autopsy.

PMCT provides an important support to post-mortem examinations used in court due to the immediacy of the images to be used in the reconstruction of events, as a means of consultation and of objective and repeatable proof.

Keywords: PMCT, Autopsy, Forensic radiology

Fracture dating: Comparing accuracy between morphological and quantitative analyses of MR data

K. Baron, T. Widek, S. Ferik, T. Ehammer, S. Heinze, E. Scheurer.

Ludwig Boltzmann Institute for Clinical-Forensic Imaging, Graz, Austria and Institute of Forensic Medicine, Medical University Graz, Austria

To evaluate the accuracy in fracture dating using qualitative and quantitative MRI data and the comparison of both approaches.

During a longitudinal study examining healing fractures, 75 MR datasets of 35 test subjects were acquired and analysed. Two blinded radiologists (one being also a medical examiner, one a clinical radiologist with forensic experience) determined the age of fractures based on qualitative MRI data. A third blinded examiner with basic training used quantitative MRI data to analyse 10 fractures by comparing T1 and T2 relaxation times to reference values. Both approaches were compared regarding their accuracy in dating fractures.

The agreement between both radiologists regarding qualitative data was moderate with an ICC of 0.4. However, both radiologists correctly determined fracture age, with an accuracy of up to 39%. The preliminary quantitative analysis showed an accuracy of 30% (3 out of 10), however, after including information regarding the sex of the test subject the accuracy increased towards 60%.

The results show that MRI can add valuable information concerning the

Both approaches seem equivalently accurate in their current state, however the quantitative approach may have more potential to increase the accuracy when compared to radiological examinations.

Keywords: Fracture analysis, qMRI

Death from displacement of airway stents

Lene Warner Thorup Boel, Lars Uhrenholt, Marianne Rohde

Department of Forensic Medicine, Aarhus University

Case reports illustrating the importance of post mortem CT for documentation of displacement of airway stents

Two cases where the deceased had a silicone stent in the trachea. Post mortem CT was performed before autopsy. Case 1 was a woman who died the day after having a replacement of a tracheal stent. Case 2 was a man, handicapped from a traffic accident with brain injury and having a tracheal stent, who was found dead.

In case 1, the stent was found displaced to the tracheal bifurcature. The cause of death was presumed to be suffocation due to inadequate air passage in the trachea. In case 2, the stent was shifted to the left and compressed due to a large benign tumor of the thyroid gland. The cause of death was presumed to be suffocation from a compressed trachea possibly in association with an epileptic seizure

Tracheal stents have been used in the past decades for treatment of various conditions involving the airways. Stent migration is a well-known complication, but death associated with tracheal stents is rare and usually caused by hemoptysis or related to the surgical procedure. Post mortem CT serves as important documentation that displacement of a tracheal stent contributed to death

Keywords: Tracheal stent, airway stent, post mortem CT

Distribution of skull and facial fractures according to circumstances of death

Lene Warner Thorup Boel, Lars Uhrenholt, Alice Svensson

Department of Forensic Medicine, Aarhus University

To describe the distribution of skull and facial fractures according to the cause of death, manner of death and mechanism of trauma

Deceased autopsied at the Department of Forensic Medicine, Aarhus University in the period 2008-2015 in which a fracture to the face and/or skull were detected and a post-mortem CT was performed

A total of 211 deceased were included in this study, consisting of 167 males and 44 females. The most common cause of death was traumatic lesions to the brain and nervous system (54,5%). The most common manner of death was accident (61,1%) of which the most common mechanism of trauma was a traffic crash. The commonest facial fracture among females was maxilla (45,5%) and zygoma (37,7%) among males. The commonest skull fracture among females was parietal (52,3%) and temporal (59,9%) among males.

The findings revealed that facial fractures were common in relation to natural death and active blunt trauma. Skull fractures were present in all suicides. Males were shown to commit suicide more violently than females. Interestingly, one in five females with a skull or facial fracture had been killed.

Skull and facial fractures varies within a forensic postmortem population

Keywords: Cranial fracture, post mortem CT scanning

Accuracy of PMCT with Death Investigation and Toxicology Re-ports for Cause and Manner of Death as Determined by Conventional Autopsy

Bolster, Ferdia MD; Ali, Zabiullah MD; Sheroke, Amanda; Daly, Barry MD; Fowler, David MD

Office of the Chief Medical Examiner and Radiology Department, University of Maryland, Baltimore, U.S.A.

To compare the accuracy of PMCT with both death investigation and toxicology reports (PMCTit), for cause of death (COD) using conventional autopsy (CA) as standard of reference. A second-ary aim was to determine accuracy of PMCTit for the manner of death (MOD).

Two readers interpreted PMCTs in 303 consecutive decedents who underwent PMCT and CA as part of death investigation over a period of 7 months. The COD and MOD were determined based on the combination of PMCT findings, the scene investi-gation, medical reports, and toxicology results. Sensitivity and positive predictive value (PPV) with 95% confidence-intervals (95%CI) were calculated. Observed agreement between [COD PMCTit vs COD Autopsy], and [MOD PMCTit vs MOD Autopsy] were calculated.

These were 207 males (68.3%) and 96 females (31.7%). Age range was 0-94 years (mean 37.2 years). PMCTit accurately determined the COD in 89.4% of cases, and MOD in 89.1% of cases. Observed agreement between [COD PMCTit] vs. [COD Autopsy] was 100% concordant for drowning, gunshot related deaths, sharp force injuries and asphyxia, and excellent (>80%) for trauma (97%), infant (87.5%), and drug overdose-related deaths (87%). Observed agreement between [COD PMCT it] vs. [COD Autopsy] was good (74.2 %) for natural deaths.

When interpreted in combination with death scene investigation, medical reports, and toxicology results, PMCT correlates favora-bly for COD and MOD as determined by CA

In selected cases PMCT can play an important role as a triage tool, to determine when conventional autopsy may not be re-quired.

Keywords Postmortem CT, Autopsy, Cause of Death, Manner of Death

Occipital condylar fractures – rare or unrecognized injury during traditional autopsy?

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Occipital condylar fractures (OCF) practically are not examined during traditional autopsy due to anatomical location, therefore are considered as rare injury. The aim of this study is to determine the true frequency of OCF based on postmortem computed tomography examination (PMCT) conducted in traumatic cases.

438 PMCT studies performed in Department of Forensic Medicine Medical University in Warsaw between November 2014 and December 2016 on victims of: traffic accidents, falls from height, batteries and low energy head injuries with known circumstances were analyzed retrospectively. The cases with OCF were divided into three subgroups. Type I-an impaction-type fracture, with a comminution of the condyle, type II-as part of a basio-occipital fracture and III-an avulsion type. Statistical analysis of all data has been performed. Further, more detailed analysis of cases with OCF type I and III-the most useful for the reconstruction purpose, including data from the autopsy protocols will be conducted.

OCF was present in 22,6% cases (n=99), the most often occurred in cases of hitting by train (48,5%, n=17), falls from height (26,6%, n=29), in cyclists (24%, n=6) and pedestrians hit by a car (22,5%, n=29). There were no OCF in fatal battery cases and low energy head injuries. Isolated OCF were found in 5,5% of cases, the most often in cyclists (12%, n=3) and pedestrians hit by a car (9,3%, n=12).

PMCT revealed that OCF is quite common in deaths caused by high-energy mechanical injuries and can be useful for the reconstruction purpose

Keywords: postmortem computed tomography, occipital condylar fractures

Identifying suspects by matching hand photographs with video evidence

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Reports by minors of sexual relations against their will are not rare, and in some cases pornographic photography is a part of the abuse. Such material can be used to help identify the perpetrator. We examined the efficacy of visual comparison between high resolution photography and low resolution video image stills of the hand.

We obtained single blinded still images from video recordings and high quality camera images of the back of the right hand from 51 Caucasian male volunteers. The images were compared in pairs (2601 combinations) and a judgment was made about whether they were a highly likely, possible or unlikely match, using an algorithm based on several types of anatomical features as markers for comparison.

All 51 high quality images were correctly matched with the video image from the same person, though in some cases there was up to 5 other samples that could not be excluded as possible matches. In total there were no false positive “highly possible” matches, but there were 50 false positive “possible” matches.

Visual comparison of the back of the hand is a valuable addition to the burden of evidence in a judicial setting, but should not be used as a standalone method to establish proof of identity. The applicability of the method is dependent on the existence of a database of reference images; the degree of certainty of the identification is directly correlated to the size of the database.

Keywords: Forensic image comparison; Hand photography; Forensic anthropology; Photographic evidence

Value of un-enhanced post-mortem computed tomography in the detection of traumatic abdominal injuries

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To determine the accuracy of unenhanced post-mortem computed tomography (PMCT) in detecting traumatic abdominal lesions

The population was collected retrospectively from the “virtopsy” database in a period of 5 years in a single institution. Traumatic deaths who benefited from both PMCT and classical autopsy were included, excluding cases of gunshot injuries. Liver, spleen, pancreas and kidney injuries and hemoperitoneum were searched. Sensitivity, specificity, negative (NPV) and positive (PPV) predictive values of the PMCT as a whole and for each finding were estimated using the autopsy report as gold standard.

For the 71 cases included from victims of a traumatic event (52 males, 19 females, median age of 38,6 years), PMCT as a whole has shown to have a low sensitivity (80%) and a high specificity (94%), with a PPV of 98% and a NPV of 59%. The highest sensitivity was obtained for the detection of hepatic lesions (69%) and the lowest for pancreatic lesions (12%). PMCT was very specific (100%) for the detection of hemoperitoneum, with a PPV of 100%. A high NPV was found for the detection of perihepatic hematomas (98%).

Major studies reporting the accuracy of PMCT for traumatic abdominal lesions are limited. The low sensitivity and NPV showed in our study discards the PMCT as an alternative to the conventional autopsy to diagnose and rule out traumatic abdominal lesions. Nevertheless, it remains a helpful tool and its accuracy would be increased by the use of PMCT angiography.

Keywords: Un-enhanced post-mortem computed tomography, polytrauma, abdominal lesions, abdominal injuries, accuracy

Unexpected brain finding in pre-autopsy postmortem CT

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Forensic pathologists often face great danger from spreading infections during autopsies. Pre-autopsy postmortem imaging can reveal potentially infectious foci and thus enable forensic pathologists to enforce protective measures during autopsies. Pre-autopsy imaging is also helpful for early differential diagnosis. Combining imaging and autopsy findings improves the quality of forensic investigations.

A man was found dead on his bed and was delivered to Institute of Forensic Medicine for further investigation. Pre-autopsy imaging performed on a CT scanner and images were evaluated on a multimodality workstation. Then, autopsy and microbiological sample collection took place.

Postmortem CT (PMCT) revealed a hypodense lesion in the frontal brain lobe, compatible with abscess or necrotic tumor. In addition, PMCT revealed frontal sinus opacification and a small osseous defect in the frontal bone adjacent to the lesion. The autopsy and microbiological culture confirmed the brain abscess diagnosis.

This case highlights how PMCT is useful for early differential diagnosis and enables forensic pathologists to protect their own health by wearing appropriate clothing during autopsy. Complementary use of imaging, autopsy and microbiology set the final diagnosis. The abscess originated from a chronic frontal sinusitis which had spread by continuous expansion through the eroded posterior wall of the frontal sinus.

PMCT enables forensic pathologists to adapt their autopsy approach by wearing protective clothing. It is of primary importance to match and complement PMCT with other methods' findings to improve the quality of forensic investigations and set final diagnosis.

Keywords: Postmortem computed tomography; brain abscess; Streptococcus anginosus; sinusitis; autopsy

3D Printing Applications for Medicolegal Practice

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The purpose of this presentation is to provide examples of how 3D printing can assist forensic practitioners in criminal reconstruction and documentation for long term evidence preservation.

3D reconstructions from CT, MRI and laser scanning technologies have been used in the documentation of pathologies, human identification and even in child abuse investigations. In the past, 3D printing was cost prohibitive but more consumer friendly desktop printers are making the process affordable.

Applications of 3D printing will be demonstrated with some of the strengths and pitfalls of the technology highlighted through specific case examples. With a variety of printers and print materials available, the intended application (be it experimental, demonstration etc.) is only limited by printer capability and model complexity.

3D printing allows for a tangible representation of evidence that can be utilized in court for juries and also provide the opportunity for subsequent analyses after a body has been released or after a surviving victim has healed. 3D prints allow for the display of evidence in a non-prejudicial manner. It has been shown that juries respond better to 3D visual aids as opposed to gory autopsy or trauma photos. 3D printing is a viable tool available to forensic practitioners for evidence documentation, preservation of evidenced, real world analyses and useful in court room demonstrations.

Keywords: 3D Printing, Forensic, Reconstruction, Child Abuse

Death due to aortic dissection or rupture – comparison of postmortem CT (PMCT) and multi-phase PMCT angiography (MPMCTA), against autopsy.

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We analysed the performance of postmortem computed tomography (PMCT) and multi-phase PMCT angiography (MPMCTA) compared to medicolegal autopsies in cases of sudden death associated with aortic pathology, this includes sudden: natural (ND) or unnatural death (UND), directly related to aortic dissection and/or rupture.

We retrospectively selected all cases concerning aortic dissection or rupture autopsied at our centre between 2013 and 2014. Autopsy was preceded by PMCT, and where possible MPMCTA, as per the established protocol developed by Grabherr et al. Results of 3 imaging items (aortic lesion presence, it's location, and pericardial fluid presence) were compared against autopsy findings.

Our study of 35 cases underwent PMCT (ND:12; UND:23), with 21 cases undergoing MPMCTA (ND:11; UND:10). For all three items studied, and especially so for the identification and localisation of aortic lesions, MPMCTA was superior to PMCT. PMCT showed false negative results for the presence or location of an aortic lesion in 10/14 cases (71.4%) against 3/21 (14.3%) for MPMCTA. MPMCTA was falsely positive for the presence or location of aortic lesions in 1/14 cases (4.8%). Pericardial fluid was missed in 1/35 (7.5%) by PMCT, however was falsely positive in 2/14 cases (14.3%) and MPMCTA in 1/21 (4.8%).

PMCT and less often MPMCTA, are already incorporated into routine work at numerous forensic institutes. In cases of death due to aortic pathology, they give useful information on the presence of aortic lesions and pericardial fluid, and lesion location.

MPMCTA was superior to PMCT for items studied, although autopsy remains the gold standard.

Keywords: Forensic imaging; Postmortem computed tomography (PMCT); Multi Phase PMCTA – angiography; Sudden aortic death; Autopsy

The use of deep learning in forensic medicine – a feasibility study

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The amount of data generated by modern medical scanners can be huge, especially in a forensic setting, where the entire body is documented in high resolution. For a forensic case, reading of images can therefore easily take several hours. A solution to these issues could be the use of deep learning techniques.

We hypothesize that deep learning techniques might help in automatically detecting and segmenting cases of hemopericardium in PMCT.

We used the ViDi Suite 2.0 as a deep learning image analysis software. 28 cases (20 male, 8 female) of hemopericardium were selected retrospectively. For each dataset, one predefined slice was extracted, windowed and converted to the PNG format. We tested the performance of the software to classify and segment a hemopericardium by using 50% of the input data for training and the other 50% for validation. Training was repeated 20 times, randomly selecting different images for training and validation.

For classification, the software achieved an average f-score of 0.79 ± 0.1 (max 0.96, min 0.54). The f-score for the correct segmentation of the hemopericardium was 0.8 ± 0.02 (max 0.84, min 0.78) compared to the manual segmentation serving as reference.

The deep learning software was able to detect and segment a hemopericardium with reasonable success considering the limitations. While this technique is not yet feasible for routine use, we could demonstrate that deep learning might be a suitable tool to solve the problem of large datasets in forensic medicine in the future.

Keywords: Deep Learning, PMCT, hemopericardium, image analysis

Comparison of computed tomography brain and soft tissue windows to evaluate frozen artifacts in the liver and gallbladder of animal cadavers

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The purpose of this study was to compare the computed tomography (CT) brain window (BW) and the soft tissue window (STW) in identifying frozen artifacts (FA) and to characterize the appearance and Hounsfield units (HU) of these FA in the liver and gallbladder of inadequately thawed cadavers.

Fourteen animal cadavers of different species were frozen and thawed at the room temperature (15-35°C) for one to two days. Three investigators evaluated the transverse post mortem CT images. Soft tissue (WL 40/WW 350) and brain (WL 50/WW 100) windows were used to detect and characterize the FA in the liver and gallbladder, and the HU were recorded.

Compared to the STW, the BW allowed better delineation and identification of FA in the liver parenchyma. Only 47% of the liver FA identified using BW was noted in STW. Commonly identified liver FA include the 'crescent line' appearance and centrally hypoattenuating 'frozen' regions. The mean HU of the liver FA was 33 HU and the presumed normal liver parenchyma have higher tissue attenuation up to approximately 70 HU. The gallbladder was better visualized using STW than BW. Common gallbladder FA include 'icicles' and 'sherbet' appearance within the lumen. The mean HU of the gallbladder frozen content was -22 HU.

Different detected appearances of FA became more conspicuous with the BW showing the relevance of its use in frozen cadavers.

The addition of the BW to the conventional STW is important to identify and characterize FA present in the liver and gallbladder of animal cadavers.

Keywords: PMCT, brain window, soft tissue window, frozen artifact, animal

Development of mechanical screening system for personal identification

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We presented our study "Development of a new personal identification method" at the 4th ISFRI. This method is performed using Procrustes analysis between two images. This time we have improved the method which can refine the same person candidates by semi-automatic mechanical operation using Procrustes analysis.

For 252 CT panoramic images and panoramic X-ray images, the x and y coordinates of the landmarks on the tooth sockets were recorded. Each image was divided into six regions and the overall Procrustes distance (d) was calculated. All combinations that can be taken among the 252 cases were calculated by Procrustes analysis.

Considering the alveolar lack portion, d / \sqrt{k} divided by the square root of the total number landmarks (k) was verified for differences between the same person group and non-identical person group.

Distribution on the histogram was somewhat asymmetrical, so we converted it into $d' = \ln(1000 \times d / \sqrt{k})$ in order to make it closer to the normal distribution.

The average d' for the same person group (n=341) was 4.59 and the standard deviation was 0.18., which were 5.10 and 0.18 for the non-identical person group (n=31,285).

The smaller d / \sqrt{k} indicates the closer the coordinate distribution on the image. The results suggested that candidates could be easily refined to 70 % or less with a probability of 1.5% using this method.

This method proved that it was an useful screening system for personal identification.

Keywords: Personal identification, Panoramic CT, Panoramic X-ray, Procrustes analysis, Forensic odontology

Estimation of body weight from effective radiation dose of whole-body CT

Purpose

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Documentation of the visual appearance is required in any forensic report, including body weight of the decedent. Due to a failure of our in-house, floor-embedded weighting scale, we developed a method for body weight estimation based on postmortem computed tomography (PMCT) using automated dose modulation, as each case underwent PMCT in our institute. The aim of this study was to evaluate the correlation between effective milliamperere second (mAs_{eff}) values, based on automatic exposure control, and body weight for the purpose of determining body weight just by the means of PMCT.

The study population comprised 349 (114 female, 234 male) decedents. In a retrospective evaluation the previously listed weight measurements, using the embedded weighting scale, were correlated with the PMCT mAs_{eff} value of the automatically provided patient protocol. All data were statistically analyzed.

An excellent correlation between mAs_{eff} values and body weight for the whole study population was revealed, which allows for calculate a conversion factor.

The present method based on computed tomography using dose modulation techniques is an accurate and quick possibility to determine body weight of decedents and shows potential for further application areas, e.g. in pediatric radiology for weight-based application of contrast media during emergency computed tomography treatment.

Postmortem CT findings of decedents with a short postmortem interval and excessive gas- and/or fluid-filled distension of the bowels

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The aim of this small case study was to assess postmortem CT findings in non-traumatic cases with a postmortem interval of less than three days displaying excessive bowel distension.

9 adult decedents with excessive bowel distension underwent postmortem CT. CT findings have been assessed regarding autopsy findings and bacteriological analyses.

In 6/9 cases CT findings were confirmed by autopsy and in 2/9 cases autopsy did not reveal further conclusion. The cause of excessive bowel distension was identified by means of CT in 6/9 cases and was related to bowel obstruction (n=5) or paralytic ileus (n=1). One case showed a strong indication for bowel obstruction causing bowel distension; however, autopsy did not confirm bowel obstruction or bowel injuries. In 6/9 cases cardiac failure due to septic shock was determined as cause of death using bacteriological analyses (bowel obstruction: n=4, paralytic ileus n=1, unknown origin: n=1).

CT indicates a high correlation with autopsy (8/9 cases) and shows high sensitivity for the detection of bowel obstruction. Bowel obstruction is mostly related to cardiac failure due to septic shock.

Keywords: bowel distension, bowel obstruction, septic shock

Soft Computing and Computer Vision for Comparative Radiography in Forensic Identification

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Comparative radiography traditionally involves the comparison of consistencies and inconsistencies of ante-mortem (AM) and post-mortem (PM) radiographs, taken trying to simulate the AM's in scope and projection. However it is based on manual comparisons and thus it is a time consuming and error prone visual inspection process. The objective of this work is to describe and validate a novel computer-aided automatic paradigm based on a 3D bone -2D radiograph super-imposition process.

The proposed 3D-2D superimposition approach is based on a Computer Vision technique called Image Registration which automatically, objectively, and precisely searches for the AM radiograph (2D) acquisition parameters using an optimizer. A simulated radiograph is obtained applying the latter acquisition parameters to the 3D model and projected over the AM radiograph. A matching degree of the superimposed radiographs is calculated according to a given similarity metric considering the external contour (bone shape) of the target bone in both radiographs (AM and simulated PM).

With the goal of validating the capability of our method to precisely perform 3D-2D radiograph superimposition we used 30 CTs (from which we extracted the following 3D models: 10 frontal sinuses, 10 clavicles, and 10 patellas) provided by the Hospital de Castilla la Mancha, and obtained 5 simulated radiographs from each 3D model (50 frontal sinuses, 50 clavicles and 50 patellas).

From each of the 150 radiographs we generated three additional virtual x-rays with increasing degree of occlusion of the target bone up to 45% in order to model bone contour occlusion in x-rays.

Promising result has been found with an average overlapping error around 0,05%.

We have managed to automatize the comparative radiograph technique while providing reproducibility, objectivity, and higher precision.

Keywords: Forensic Identification, Forensic Radiology, Comparative Radiography, 3D-2D bone superimposition, Soft computing, Computer Vision.

Antemortem identification by fusion of MR and CT

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Computed tomography (CT) has become a valuable addition to radiologic identification while magnetic-resonance-imaging (MR) has only rarely been used for this purpose. In our case, identification was facilitated by fusion of MR- and CT-imaging in a living victim of assault.

A man was hospitalized with disfiguring injury that rendered establishment of his identity impossible. Head-CT was performed and the PACS featured an earlier MR of the brain. We were tasked to confirm the presumed identity by radiological identification. Images were processed with syngo.via (SIEMENS).

Unenhanced comparison of MR and CT imaging of the frontal sinuses did not allow for identification. In order to allow for identification, MR and CT data had to be adapted in contrast, windowing, and color. Subsequent fusion of the images allowed for differentiation of the two modalities and enabled identification.

Due to familiar differences in bone tissue contrast, the direct visual comparison of CT and MR imaging is challenging. The syngo.via fusion tool enables intermodal identification. This is a first step towards objective rather than subjective identification. The case also reports on the rare occasion of antemortem radiologic identification.

Intermodal radiologic identification by comparison of CT to MR imaging is feasible despite differences in tissue contrasts.

Keywords radiological identification, computed tomography, magnetic resonance imaging, paranasal sinuses

Epicardial adipose tissue estimation by computed tomography of eviscerated hearts – A forensic method study

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The purpose of this study was to investigate the ability to estimate epicardial adipose tissue (EAT) volume by computed tomography (CT) of eviscerated hearts during autopsy. Furthermore, we wanted to test the correlation between total heart volume (HV) measured by CT and heart weight (HW).

We included 144 individuals who underwent a medicolegal autopsy and did a CT-scan of the eviscerated hearts. 12 subjects were excluded due to inadequate CT-scan. Of the remaining 132 subjects included in the results, 74 (56%) were males. Mean age was 53 years (range: 22-94 years). Using the software Mimics® we determined EAT and myocardial volumes. HW was measured during autopsy. Intra- and interobserver analyses of the CT measurements were performed on 10 randomly chosen subjects.

The median HW was 405 g (range: 249-838g), median HV 354 mL (range: 209-787 mL) and median EAT volume 71 mL (range: 10-296 mL), which corresponded to 20% of the HV. HV measured by CT correlated with HW ($R^2=89\%$). Mean intraobserver differences of HV and EAT were -0.5 mL and -1.1 mL, respectively. Mean interobserver differences were 11.5 mL and 1.5 mL, respectively.

HV measured by CT of eviscerated hearts during autopsy highly correlated with HW. It was possible to estimate EAT volume using CT on eviscerated hearts. The EAT-HV-ratio corresponded with values published on data from former autopsy studies using manual dissection. We conclude that CT of eviscerated hearts may be a useful method to determine EAT at autopsy. We expect to apply this method in future research.

Keywords: Epicardial fat tissue, Computed tomography, Autopsy, Method study

An experimental evaluation of intermittent breathing in the appearance of drowning lung on postmortem CT

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Experimental drowning models were prepared to investigate the effect of intermittent breathing on lung CT images (approved by the institutional animal ethics committee).

Ten NZW rabbits (all female, mean weight 2.7 kg) were divided into 2 groups: an intermittent breathing group (BREATHE), and a non-breathing group (CONTROL). The postmortem time course was examined by CT in all rabbits. Each rabbit's head was submerged in a water bath for 3 seconds with 2 seconds breathing in the BREATHE group or was continually submerged in the water bath for 5 minutes in the CONTROL group. The percentage of aerated lung (< -700 HU) volume (%ALV = 100 (aerated lung volume / total lung volume)) was statistically evaluated, and the lung CT image patterns were investigated on PMCT.

All lungs had decreased %ALV in both groups. The %ALV remained in the BREATHE group than the CONTROL group ($p < 0.05$). Areas of patchy aeration remained in both groups, and there were no significant differences in the appearance of the lungs.

The agonal breathing effect did not affect the PMCT lung appearance in drowning.

Keywords: Postmortem CT, Drowning, Animal experiments

Routine prescreening for tuberculosis by post mortem CT

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4 Case reports illustrating the advantage of post mortem CT (PMCT) for prescreening of possible tuberculosis (TB). The prescreening prior to autopsy provides security at risk of postmortem transmitted infectious diseases.

A post mortem CT is performed prior to nearly all autopsies. Several cases a year have pathologic lung changes which could be characteristic for TB. The occurrence of TB and also multi-resistant TB is rising posing an increasing risk of infection for autopsy personel. If there is anamnestic information about possible TB infection and/or characteristic changes on the PMCT scans the autopsy is in many institutions performed in an equipped bio-safety autopsy room.

On PMCT 4 cases were diagnosed with lung changes possibly characteristic for TB. In 3 cases the diagnosis was confirmed by histopathology or microbiology. 1 case represented severe pneumonia confirmed by histopathology.

PMCT is of considerable value in screening cases for possible TB. The pre-autopsy diagnosis triggers a change in the handling of the autopsy and minimizes a potential infectious risk for autopsy personel.

PMCT is an important prescreening method for possible tuberculosis infections prior to autopsies.

Keywords: Tuberculosis, infectious disease, post mortem CT

Can we predict nutritional status from the skeleton? Inputs from forensic radiology.

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One of the aims of forensic anthropology is to recover people's identity from their skeletal remains. Body mass (BM) being an important parameter of the human body, it could be added as an element of the biological profile. However, it is not possible today to estimate individual BM from bones. BM is also known to be the most confounding factor in age estimation based on the skeleton. Therefore, it would be beneficial to be able to identify someone's nutritional status, especially when it is out of the normal range. Nutritional status is usually estimated using the body mass index (BMI).

The diaphysis of long bones is known to “record” changes that are imposed on the bone throughout the life course. Diaphyseal thickness can notably be measured through CT scans. Additionally, in contrast to clinical data where information is often self-recalled, most forensic radiologies include reliable data of stature and BM.

We explored the correlations between BMI and the femoral diaphysis with data extracted from whole-body CT scans taken before autopsies on 36 adult males representing all the age range and various nutritional statuses. We developed strategies to extract semiautomatically data of bone thickness on the femoral diaphysis. Then, we built a crossvalidated decision tree for exploring whether bone thickness could predict BMI categories. The results show that specific measurements of cortical area can easily distinguish extreme and normal weights.

This study demonstrates how forensic radiology can be used to help developing important methodologies that would highly benefit the bio-anthropological field.

New formula for cardiothoracic ratio for the diagnostic of cardiomegaly on post-mortem CT

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The cardiothoracic ratio (CTR) is considered to be a reliable detector of cardiomegaly on the CT for livings. Our study aimed to establish an adjusted CTR based score to predict cardiomegaly at post-mortem computed tomography (PMCT).

We selected adult's autopsy cases examined between 2009 and 2016. Two groups (normal heart weight and an overweighed heart) were considered (according to calc.chuv.ch). The CTR was measured on axial images. Logistic regression analysis was performed to investigate the discriminating power of the CTR between groups when adjusting to the confounding factors.

120 cases with normal heart weight and 100 cases with overweighed heart were analyzed. The factors associated to the cardiomegaly are CTR (p-value=0.003, OR =3.57), BMI (p-value= 0.055, OR=1.09), age (p-value <0.001, OR=1.67) and gender (p-value 0.002, OR=4.85). An integer-based point-scoring system was derived based on their β -Coefficients. The score ranged from 21 to 45 with highest values indicating a more likely cardiomegaly. For a threshold of 33, the sensitivity, specificity and the correctly classified were 0.84, 0.78 and 0.81 respectively. The discriminatory power was calculated by the area under the ROC curve auc=0.91.

CTR alone cannot be used to discriminate between normal heart weight and overweighed heart at PMCT. A new formula has been developed, including age, gender and BMI allowing to overpasses this subjective step.

The adjusted CTR based score is a simple and performant scoring system to diagnostic the cardiomegaly at PMCT.

Keywords: Cardiothoracic ratio, post-mortem Computed Tomography, cardiomegaly

Relationship between postmortem MR relaxation time and body temperature: Is scan parameter optimization necessary?

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To investigate the relationship between postmortem MR relaxation time (RT) and body temperature, and to seek possibility of scanning parameter optimization.

Postmortem 1.5T-MRI was performed one day before autopsy, measuring RT in the brain (30 cases), cerebrospinal fluid (CSF) (28 cases), fat (28 cases), heart (32 cases), liver (22 cases), and muscles (26 cases). T1- and T2-values of deceased bodies were compared with living bodies. The relationship between RT and rectal temperature was assessed using Pearson's correlation coefficient. Optimization of scan parameters was investigated by approximation of RT and temperature for items in which significant differences were noted.

T2-values of CSF were too long to measure. T1-values of CSF and fat were very different (0.96 and 0.90, respectively) with large standard deviations. Correlations between RT and temperature (mean: 16°C; range: 5-32°C) were noted for T2 values of the heart, liver and fat, though the correlation was not significant for T1 values of the liver. Optimization of scan parameters improved image quality for fluid-attenuated inversion recovery (FLAIR) and short-tau inversion recovery (STIR) sequences.

Strong correlations between T1-values and temperature in CSF and fat are believed due to relatively small postmortem tissue changes in CSF and fat. Other measured portions had marked postmortem degeneration due to autolysis and pH change, suggesting causes for negligibly small correlation between RT and temperature.

Scan parameter optimization is considered necessary for FLAIR and STIR sequences by utilizing T1-value differences, which will help delineation of abnormal findings in deceased bodies.

Keywords: postmortem magnetic resonance imaging, low body temperature, temperature dependence, T1 and T2 values, scan parameter optimization

Basal subarachnoid hemorrhage following violence-related minor blunt trauma to the head: Evaluation of vascular injury with post-mortem CT angiography

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To investigate the utility of post-mortem CT angiography (PMCTA) to demonstrate vascular injury in cases of unexpected death with basal subarachnoid hemorrhage (SAH) after sustaining minor blunt head trauma.

Among forensic investigations with PMCTA performed as a pre-autopsy process, 12 cases (11 males, mean age of 37.8 ± 9.8) were retrospectively selected based on their clinical history with violence-related minor head trauma. Abnormalities found in PMCTA were further investigated during subsequent dissections and also compared with ante-mortem CTA findings when available. PMCTA data (n=34) unrelated to violence were compared to identify possible post-mortem vascular artifacts.

PMCTA demonstrated basal SAH (in all), vertebral artery (VA) rupture or occlusion (n= 11), and basilar artery occlusion (n=1). Although basal SAH was demonstrated in all at subsequent autopsy, however, direct visualization of VA injury was possible only in two cases. Ante-mortem CT was available in 3 and showed vertebral (n=2) and basilar (n=1) artery injury, corresponding to PMCTA findings. PMCTAs for control (n=34) demonstrated no vertebro-basilar abnormalities except for contrast under-filling of neck vessels associated with increased intracranial pressure (n=4) or contrast extravasation from cannulation (n=1).

VA injury has been regarded as the major vascular pathology of basal SAH in assault causing death following minor head trauma. In this study, PMCTA suggested traumatic vertebro-basilar injury in all those cases.

PMCTA may be used for more focused investigation of vertebro-basilar system and also for the indirect diagnosis of VA injury when it is not accessible by autopsy dissection.

Keywords: Post-mortem computed tomography angiography; Assault; Vertebral artery; Vascular injury

Reconstruction of reflective surfaces such as vehicle mirrors based on 3D scan data for visibility simulation

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For three-dimensional (3D) reconstructions of vehicle collisions, visibilities, including vehicle mirrors, are often part of the forensic question to be answered. We present a procedure that allows the simulation of visibilities of real vehicle mirrors using structured light scan data of these mirrors.

In a setup containing a black-and-white checkered pattern, six vehicle mirrors were scanned with a laser scan and a structured light scanner. Photographs from different angles were taken with a digital single lens reflex camera (DSLR). The structured light scan data were processed using Geomagic Wrap. The processed mirror surfaces were imported to 3ds Max. A mirror material was assigned to each surface and the images were rendered using the Nvidia Mental Ray raytracer. The laser scan data were used to create a virtual camera and virtual images with the same perspective as the DSLR and to rectify the photographs. Virtual and the rectified photos were compared to analyze the quality of the mirror simulation.

Five of six virtual mirrors simulated the behavior of the real mirrors correctly.

Surface scans of vehicle mirror allow for the creation of reconstructions that help answering forensic questions regarding visibilities. Even the behavior of convex mirror surfaces could be replicated. Data acquisition, image rectification and data processing influence the quality results.

Structured light scans of mirror surfaces might be used to create virtual mirror surfaces for 3D vehicle collision reconstructions

Keywords: 3D visualization, structured light scanning, mirror reconstruction, 3ds Max, Geomagic Wrap

Post-mortem Hippocampal Measurements in Mentally Ill Individuals

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Studies have shown that an extended period of increased stress may affect the volume of the hippocampus. It is known that mentally ill individuals are exposed to stress due to their illness and lifestyle. The aim was to develop a method to determine the hippocampal volume using post-mortem MR (PMMR).

We examined 58 deceased individuals suspected to suffer from severe mental illness, all from the Danish national SURVIVE-study. The individuals were divided into three subcategories (schizophrenia, depression and controls) based on information from the police reports.

We developed a PMMR- based segmentation algorithm that allowed us to investigate the hippocampal volume. The segmentation algorithm relied on differences in PMMR-signal intensities and anatomical landmarks allowing manual segmentation. Preliminary studies were carried out comparing different MR-settings and by comparing the PMMR-based hippocampal volumes (in situ) with ex situ hippocampal volumes derived from dissection of the hippocampus at autopsy. Cases were examined for intra- and inter-observer agreement.

The developed segmentation algorithm showed a high reproducibility. We did not find any statistically significant differences in hippocampal volume regarding psychiatric diagnosis, brain volume or gender. However, there was a tendency towards smaller left hippocampal volumes for the male schizophrenic individuals.

The segmentation algorithm will be applied in further examination of the SURVIVE cohort as the hippocampal volumes will be compared with the level of cortisol measured by hair analyses and the activity of the HPA-axis.

This study presents a validated segmentation algorithm for determining the hippocampal volume by PMMR and anatomical landmarks.

Keywords: Hippocampal volume, Post-mortem MR and Forensic Pathology

Evaluation of cervical spinal injuries by post-mortem MRI with gradient echo sequences

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Non-invasive death investigations based on post-mortem CT have many limitations. False negative of some cervical spinal injuries is one of the problems. The purpose of this preliminary study is to know the feasibility of detecting cervical cord injuries by post-mortem MRI and the role of gradient echo sequences for this task.

Post-mortem CT (Eclon, Hitachi Ltd, Tokyo, Japan) and post-mortem MRI (1.5 T, Intera Achieva, Philips, Amsterdam, Netherland) were performed for 9 cadavers without severe decomposition. The neck of each case was scanned by spin echo T2 and T1 weighted image, short tau inversion recovery (STIR), T2 star weighted image and three-dimensional, gradient echo T1-weighted image. Forensic autopsies were performed after the scans and the pathologists performed cervical spine evaluation in the same way including posterior-side neck opening in each case.

There was one case with cervical spine injuries including cervical cord hemorrhage and intervertebral disc injury which were false negatives in post-mortem CT. MRI with gradient echo sequences showed these findings clearly. Although MRI showed false positive findings in 3 cases, evaluations by experienced forensic radiologists and gradient echo sequences seemed to overcome these problems.

Addition of post-mortem MRI with gradient echo sequences to post-mortem CT will improve non-invasive detection of cervical spinal injuries.

Keywords: Post-mortem MRI, cervical spine injuries, T2 star weighted image, gradient echo imaging

Forensic Evaluation of Crania Recovered from Archaeological Excavations Exhibiting Evidence of Sharp Force Trauma

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The authors examined human skulls originating from the eighth to thirteenth centuries AD. In this period of history combatants were subjected to stabbing, slashing and chopping injuries. Our goal was to determine if the victims were able to survive their wounds.

We examined five skulls with sharp force trauma injuries. The skulls were discovered by archaeologists during the twentieth century in excavations. The skulls underwent direct visual examination as well as with the aid of spiral CT images provided by the Department of Radiology, Semmelweis University.

We have determined that some of the victims survived their injuries, as evidenced by the CT images in which the bone defects had smoothed edges in these cases. The implements which inflicted these wounds on the ancient victims' skulls were characteristic of the close quarters and long range weapons in use in their respective periods.

Weapons enable attacks and defensive parries to extend beyond the limits of the human body, increasing their destructive force and distance. Whenever the force exerted from the impact of a sharp-edged implement striking the cranium overcomes the resistance of the bony structure, disrupting its continuity, the result is a fracture. Several weeks are required for the bone to regenerate, even in cases that are free of complications.

The study of historic Hungary's cranial injuries reveals the mechanisms of injury typical of the given era, refers to the type of implement used, sheds light on the therapeutic methods in use and the odds of surviving.

Keywords: cranial trauma, sharp injury, archeology, cranial radiography, CT imaging

Post-mortem CT in criminal disposal of homicide victims. A ten-year retrospective study in Padua

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To withhold homicide victims is a way to destroy evidence of crimes and to prevent the body discovery and identification. This study's purpose is to analyze the characteristics of concealment of corpse and the role of Post-Mortem Computed Tomography (PMCT) in these cases.

A retrospective analysis of murders' autopsies in cases of corpses' concealment carried out in Padua (from 2006 to 2016) was performed. Victim's features, method of concealment, autopsy and PMCT findings were recorded and the usefulness of forensic imaging was evaluated.

In all 13 cases identified, a total-body CT-scan was performed. The most frequent methods of concealment were abandonment in an isolated area (6) and submersion (3). Charring and grinding in small pieces were found associated with other methods of disposal. The most frequent causes of death were skull-brain trauma (7) and hemorrhagic shock (6) due to blunt (8) and bladed weapons (4). PMCT contributed to identify the victim in 2 cases and recognized the cause of death and the means of production in 10 cases.

In our series, PMCT, as part of a multi-disciplinary approach, was useful for the preliminary assessment of the body before autopsy, for the identification of the victim and the cause and means of production of death. Although the low number series must be implemented, this study suggests that PMCT is fundamental to perform a complete forensic examination in corpses altered by cloaking mode, providing detailed information on bone and internal lesions and through recognition of identification data.

Keywords: PMCT; concealment of corpse; autopsy; homicide

Forensic radiology in the DVI operation for the Wang Kelian clandestine graves in Malaysia

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The remains of 155 suspected Rohingya human trafficking victims were discovered between May and August 2015 along the Malaysia-Thailand border at Wang Kelian, Malaysia. Whilst a few of the remains were above ground, the rest were buried in clandestine graves. A Disaster Victim Identification (DVI) operation was initiated and the remains were exhumed. The use of radiology during the DVI operation will be described.

The postmortem phase was carried out by forensic medical teams, including radiologists, at a regional tertiary hospital where the mortuary has access to the hospital imaging services. The remains were in varying stages of skeletonisation and a few were commingled. All remains were X-rayed using mobile X-ray units at the mortuary to an agreed protocol and the images were reviewed by the radiologists prior to the postmortem examinations. Computed radiography (CR) and a picture and archiving communication system (PACS) were utilised throughout.

Radiological examination of the 155 remains provided postmortem data related to skeletal deformities and trauma, retained foreign objects and nutritional status, but proved less useful for sexing and ageing.

It was the largest and the first DVI operation in Malaysia to utilise CR and PACS; enhancing the DVI workflow by reducing the imaging turnaround time besides providing high quality and cost-effective imaging data that is easily stored and retrieved. However the absence of antemortem data precludes reconciliation and temporary controlled burials were done for all the remains.

The use of CR and PACS has enhanced the efficiency of forensic radiology in DVI work.

Keywords: Forensic radiology, DVI, clandestine graves, CR and PACS, human trafficking

The value of Postmortem Computed Tomography (PMCT) in differentiating between live birth and stillbirth.

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In the investigation of suspected neonaticide, the evaluation of aerated lungs is more useful compared to vital reactions in the umbilical cord and food in the stomach as most of these cases have short survival period. However, the conventional flotation tests may be equivocal. Therefore, the air/gas distribution in PMCT images in comparison with flotation test will be described to assess its value in assisting pathologists to differentiate between live birth and stillbirth.

The findings of PMCT of 4 suspected neonaticide cases were reviewed and compared to the findings of flotation tests during autopsies.

The PMCT findings of all the cases were consistent with the flotation tests; lack of aeration in the lungs and gastrointestinal tracts on PMCT corresponded with negative flotation tests, and extensive air/putrefactive gas in the lungs and other spaces corresponded with false positive flotation test in the decomposed newborn.

These observations indicate that PMCT is a useful adjunct to conventional flotation test for pathologists to consolidate their opinion of stillbirth when the lung flotation test is negative or falsely positive. Nevertheless, given the limited number of sample size, we were unable to demonstrate the benefit of PMCT in forming opinion of live birth in false negative flotation test.

Future analysis with a larger sample size with known stillbirths and live births is recommended to further evaluate the usefulness of PMCT in differentiating between live birth and stillbirth.

Keywords: PMCT, flotation test, neonaticide, live birth, stillbirth

Optical coherence tomography (OCT) study on reproducibility of corneal pachymetry map results after death

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To assess the inter-observer reproducibility of pachymetry map results obtained by using a portable OCT system between two well-trained physicians with different specialization (ophthalmology and forensic medicine).

Forty-six ocular globes of sheep (*Ovis aries*) were studied with a portable OCT system by two operators at different postmortem intervals (PMIs) as follows: immediately (or baseline, i.e. within 10 minutes), at the 30th minute, at the 1st, 6th, 12th, 24th and 48th hour, and later (up to the 96th hour, unless images were uninterpretable). All images were acquired using the pachymetry mapping protocol. Corneal thickness measurements were defined automatically by the iVue software. During each measurement session, corneal reflex and the sheep's head position (maintained by a mechanical support) were monitored and adjusted so that alignment beam and the central corneal reflex were coaxial. For each time-point, one scan was performed by operator 1 (MN) and one further scan by operator 2 (PEN) to calculate inter-observer reproducibility. For paired interobserver measurements, no more than 2 minutes elapsed between the first and second measurement.

The intraclass correlation coefficients revealed good to excellent reproducibility for pachymetry map results at each postmortem interval.

No significant systematic differences between measurements obtained for each PMI by observers were found as determined by the Wilcoxon matched-pairs test.

Given the significant degree of reproducibility that exists among welltrained physicians with two different specializations, reliable measurements by a portable OCT device are potentially applicable both in the fields of ophthalmology and in forensic medicine.

Keywords: OCT, PMI, corneal pachymetry reproducibility, ophthalmology, forensic science.

Can torture be inferred on the basis of PMCT interpretation?

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Torture is defined by the United Nations Torture Convention of 1984 as inflicted pain or suffering on a person for purposes of obtaining a confession, punishment for an act or intimidating another by or at the behest of a person acting in an official capacity. Rarely do such torture cases come to the attention of medico-legal death investigators and in most situations there is scant information on which to base such a claim. In modern society, however, torture has a broader meaning as defined by the Cambridge English Dictionary as an act of causing great physical or mental pain in order to persuade someone to do something or to give information, or to be cruel to a person or animal.

The skeletal injuries of 2 contrasting cases of inflicted trauma have been analysed using post-mortem CT (PMCT).

Case 1 is a heavily burnt body with multiple acute fractures involving the skull, cervical spine, ribs, left scapula and pelvis. Most of these injuries were not associated with haemorrhage at autopsy and are considered to have occurred post-mortem. Case 2 is a decomposed body with multiple acute, healing and healed fractures to the skull, facial bones and orbit, cervical and lumbar spine, scapulae, ribs, sacrum, hands and 2 amputated fingers. Several of these fractures show healing with marked deformity.

Differentiation of injury inflicted to hurt or harm an individual, and so-called torture whereby the perpetrator is fulfilling an additional purpose of coercion or self-gratification is not readily appreciable since it goes to the incentive and thoughts of the offender at the time. Yet there may be features of those injuries that can be instructive, notably a pattern of injury associated with known acts of torture or the presence of inflicted injuries that are in various stages of healing without evidence of medical intervention, and in anatomical locations that are rarely seen in routine clinical or medico-legal practice.

Although the motivation of an individual inflicting injury on another is unknowable from PMCT data alone, strong inferences may be drawn on the basis of certain CT findings. As in all PMCT interpretation these findings must be viewed in the context of known circumstances surrounding the death and the corresponding autopsy/histological findings.

Keywords: Torture, Post-mortem CT, Injury pattern.

Diagnosis of venous air embolism with the use of post-mortem CT scan

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Air embolism is a well-known pathological entity which is infrequently encountered in forensic practice. It can be divided to arterial and venous air embolism. There are well described methods to diagnose air embolism during post-mortem examination, most of them being cumbersome apart from radiology. These methods are performed only if there is a high index of suspicion prior to the post-mortem examination and hence air embolism is frequently missed.

Our department has a dedicated CT scanner where all bodies are routinely imaged prior to a post-mortem examination. CT scan is known to be a sensitive method to diagnose air embolism, however can be prone to post mortem artefact which can falsely give the appearance of air embolism. Details of four cases of venous air embolism detected on post mortem CT examination will be described, with possible artefactual air embolism seen in one of the cases. We observed that air in the right side of the heart diagnostic of air embolism was seen more frequently than expected in traumatic deaths, particularly in association with head injuries.

Our experience with the use of routine pre-autopsy CT scan is that air embolism is observed more frequently than previously anticipated. The use of CT scan is a simple and sensitive method of screening and diagnosing air embolism in addition to a host of other pathologies. The method is however not infallible as decomposition and other post-mortem change can cause similar changes resulting in artefactual air embolism.

Keywords: Post-mortem CT scan, air embolism, trauma, decomposition

A possible case of medieval child abuse

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Child abuse is characterized by multiple fractures on shafts and metaphyseal corners of long bones and on ribs. Fractures can be present on the skull, where also endocranial areas can show signs of subdural hemorrhage. We examined a medieval infant skeleton with rib fractures. The purpose was to get insights into a possible case of medieval child abuse.

The osteological examination of the 0 to 3 months old infant skeleton revealed three rib fractures. To examine the stage of healing and to reveal other traumatic changes as likely traces of child abuse all bones were CT-scanned.

We found that the rib fractures were partly healed. The fractures showed variable amount of callus formation indicating different stages of healing. The trauma was inflicted at different times, however all shortly before death. Callus formation, indicative of subperiosteal bleeding, was also found on long bones.

The bone changes found are not likely birth trauma. The presence of partly healed rib trauma can be explained as either accidental drop of the child or deliberate shaking resulting in short term survival.

This study provides insights into the life of one medieval infant. To be able to get insights into the extent of child abuse in the medieval period, the study needs to be extended with systematic recordings traces of child abuse in archaeological infant skeletons.

Keywords: Child abuse, Infant skeleton, Rib fractures, Medieval Denmark

Qualitative and Quantitative study of false starts on bones through micro-CT. Preliminary results.

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Micro-CT allows the morphological differentiation of false starts (FS) produced on bones by saws with different class characteristics (shape/set/TPI). This study aims at testing this technique for the morphometric assessment of FS with similar morphology, produced by saws of same set and shape.

Three pairs of saws of same set and shape for each couple (Saws 1-2: alternating and crosscut; Saws 2-3: alternating and ripcut; Saws 5-6: wavy and ripcut) were used to produce FS on 90 human bones. Samples were scanned by a Skyscan1172 micro-CT. The following parameters were assessed: shape of the mark; kerf and floor width; size of angles. A metrical comparison between groups of FS produced by coupled saws was performed.

FS produced by saws of the same couple showed similar shape; FS produced by saws 1 and 2 showed metrical differences in the size of angles; FS produced by saws 3 and 4 showed metrical differences in kerf and floor width; FS produced by saws 6 and 7 were not distinguishable.

This study demonstrated that, when comparing FS produced by saws with same shape and set, the qualitative assessment alone cannot gather sufficient data for the identification of the inflicting tool, and need to be followed by an accurate morphometric assessment.

Micro-CT is an accurate tool for performing qualitative and quantitative analysis of FS on bones. The proposed methodology will be validated on a wider number of lesions, in order to draft a flow chart for the micro-radiological assessment of FS on bones.

Keywords: Saw marks; False Starts; Human Bones; Micro-CT, Qualitative and Quantitative assessment.

Conventional Radiology and its Significant contribution to Forensic Anthropology

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Taking into account the advent of technology in Medical Imaging, the objective of this study was to demonstrate the validity of Conventional Radiology and its fundamental role in Forensic Anthropology.

The Forensic Radiology Service and the Anthropology Department, both of which belong to Argentine Judiciary Morgue, and the Argentine Forensic Anthropology Team (EAAF – NGO), have been working together on this expert field since 2001 in order to identify human remains, date and characterise injuries and determine the possible cause of death. Together, these Departments perform around 120 expert studies a year. All of those radiological images are obtained using a RX Dinan 500 mA.

The analysis of radiologic images have revealed foreign bodies, bullets, splinters, medical and/or dental prosthesis. These results have allowed us to determine, characterise and date bone injuries and, most of the times, determine age range and sex.

Given our experience with skeletonized and semi-skeletonized remains, conventional radiology is essential to decide between pathologies, shed light on traumatic patterns related to the cause of death, collaborate in achieve successfull identification and date ante mortem injuries. It has proved to be a cheap, reliable, effective, transportable methodology in comparison with most advanced ones. Furthermore, it returns an optimum level of detail in foreign objects and provides a clear and trustworthy interpretation of taphonomic processes.

Conventional Radiology has demonstrated highly significant relevance in identifying distinctive bone features, determining age range and sex, characterizing foreign bodies and injuries (Both traumatic and nontraumatic), analysing bone trabeculae and various bone healing processes in order to date injuries.

Keywords: Radiology, Forensic Antropology, Human remains identification.

Multi-phase postmortem CT angiography (MPMCTA): first experiences of the Forensic Radiology Unit in the University of Modena (Italy)

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Multi-phase postmortem CT angiography (MPMCTA) is increasingly being recognized as a valuable adjunct medicolegal tool to investigate the vessels of the head, thorax and abdomen. We present the experiences of the Forensic Radiology Unit of the University of Modena.

Between April 2016 and February 2017 MPMCTA has been performed in six cases of sudden unexpected death, according to the following inclusion criteria: adult caucasian male, no severe ongoing pathologies. For each case, firstly CT without contrast was done, then body fluids samples were collected for drug tests, and femoral vessels were cannulated. MPMCTA was performed following a specific injection protocol thanks to Virtangio[®] perfusion device; finally the corpse underwent autopsy. Histopathological and toxicological exams were performed.

MPMCTA showed in two cases cardiac tamponade and haemopericardium due to ascending aortic rupture, that in one case had caused antegrade and retrograde aortic dissection until iliac bifurcation and aortic valve plane, respectively. In three cases imaging demonstrated coronary artery disease; only one case was burdened by procedural difficulties. Autopsy and histopathological findings accurately reflected MPMCTA data.

Pathological remarks observed in MPMCTA allowed to guide diagnostic suspicions during the autopsy; a very close connection between autopsy and MPMCTA findings occurred. Time interval between death and MPMCTA exceeded 72 hours only in the case with procedural problems; probably the putrefactive phenomena determined technical difficulties.

MPMCTA could be very useful to determine the source of bleeding in cases of cardiac tamponade and to view vascular stenoses and occlusions; MPMCTA could fail in putrefacted corpses.

Keywords: Post-mortem computed tomography

Evaluating a new service using PMCT to replace autopsy in natural death

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In response to the increasing humanitarian and cultural concerns regarding invasive autopsy and at the request of our local Coroners, a PMCT service has been implemented in Leicester to replace some autopsies. With the Coroners consent, families may request PMCT investigations for deaths from natural causes.

A pathologist reviews the circumstances of death provided by the Coroner and does an external examination of the deceased to determine if the case is appropriate for PMCT only. The deceased are prepared in the mortuary and the scanning is completed out of clinical working hours. A plain scan and then pulmonary inflation and angiography scans are performed. We have audited the initial 18 months of this service.

Fifty cases have been scanned using this service to date. A cause of death was given in 48 cases. In two cases, no cause of death was given and autopsy was performed. In both cases cause of death was given as left ventricular hypertrophy. The presentation shows the range of causes of death and discusses the organisational and practical issues.

We have shown that using PMCT to replace autopsy is possible within the UK for some HM Coroner autopsies for natural death. We are currently planning to expand this service.

Pulmonary Thromboembolism – improving the diagnosis on post-mortem CT (PMCT)

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Diagnosing Pulmonary Thromboembolism (PTE) on PMCT is difficult, complicated by hypostasis and post-mortem (PM) clot formation. We conducted a review of diagnostic accuracy of signs new and previously reported potential signs of PTE on PMCT using autopsy as the gold standard

A blinded retrospective review of 39 PMCT cases, twenty had PTE diagnosed at autopsy and 19 controls (taken from the next natural non-PTE death of similar age identified). 1 PTE case was excluded as the full scan protocol has not been completed. All cases were assessed for clinical risk factors, appearance of pulmonary arteries & leg veins, heart chamber, major vessel and leg measurements. Receiver operator curves were created for all observations. An area under the curve (AUC) value greater than 0.675 was considered significant. Suitable cut-off values were identified for each of the observation considered significant. An algorithm produced to diagnose or exclude PE.

No individual sign could be used to predict PE. Clinical histories were of little help. Combining leg circumference differences, heterogeneity of density in pulmonary arteries and left atrial volume provided sensitivity and specificity of greater 90%.

Diagnosing PE is vital for PMCT to become a viable alternative to autopsy in natural death. We present our algorithm, which we believe will improve the diagnosis of PTE, which includes scanning the legs in all cases of natural death. As this algorithm was developed in this dataset it must be validated in an independent dataset.

Ventilated Post Mortem Computed Tomography (VPMCT). Does it really make a diagnostic difference?

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The practicalities of undertaking ventilated post mortem computed tomography (VPMCT) have been previously described for both adults and children. As a result, in our own practice we have introduced VPMCT as a standard procedure during PMCT investigation of natural and some road traffic deaths. However, there is no published research showing whether VPMCT actually assists with pulmonary diagnostic interpretation. The images appear more like clinical CT scans, but this does not validate VPMCT.

We studied the pulmonary pathology identified in 50 cases using both native and VPMCT. We considered whether ventilation assisted image interpretation and pulmonary pathology diagnosis, as compared to native PMCT, autopsy and histology findings.

The research was conducted with the approval of the local research ethics committee (amendment to original approved submission ref: 04_Q2501_64). 50 non-consecutive cases were consented for VPMCT using the previously described method of Rutty et al (Int J Legal Med. 2015;129:325-34) involving lung expansion by means of positive pressure delivered by a clinical ventilator and tube inserted in the airway via tracheostomy. Autopsy examination was the following day blind to the imaging findings, and included photography of the external and cut surfaces of the lungs and histological sampling of the lungs anterior and posterior aspects of all lobes. The native and VPMCT images were reported by 2 radiologists in consensus, independent to the autopsy findings. The PMCT native and ventilated images were then reviewed with the macro and microscopic autopsy and histology findings.

VPMCT clears post mortem lividity in many cases, allowing the CT reader to distinguish between ante mortem and post mortem ground glass changes. The VPMCT images identified the pathology seen at autopsy and also pathology not seen at autopsy. It was found that it could identify pathology caused by therapeutic procedures, as opposed to lung injury. The radiologists' confidence in making a pulmonary diagnosis on the PMCT lung images was increased, but we cannot prove that overall accuracy is increased. Positive pressure ventilation causes changes on histology that should not be mistaken for ante mortem pathology.

VPMCT has become an integrated part of post mortem imaging at Leicester. Body preparation can be undertaken by mortuary technicians or trained radiographers. The subsequent enhanced diagnostic confidence, allowed us to distinguish between ante mortem and post mortem changes in many cases.

VPMCT has an important role to play in PMCT examinations.

Keywords: Post mortem computed tomography, ventilation, macroscopic photography, histology, autopsy

The Leicester Post Graduate Post Mortem Radiology Training Courses; our experience so far.

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The purpose of the talk will be to describe the development and launch of a variety of post graduate courses at Leicester, aimed that those practicing within the world of post mortem radiology, specifically post mortem computed tomography (PMCT).

In 2016 university-accredited postgraduate level Certificate, Diploma and MSc courses were developed and launched at the University of Leicester. These were supplemented by university-accredited module-only options and Continuous Professional Development (CPD) residential week courses, certificated by the UK Royal Colleges of Pathology and Radiology. The courses use autopsy-matched, consented PMCT cases of natural and unnatural death built up over the last 10 years at Leicester. It is centred within a purpose built teaching facility and is delivered through lectures, seminars, discussion, debate and multi-disciplinary team meetings (MDT's). There are also practical skill classes, which include mortuary procedures and actual PMCT scanning, using real cases having post-mortem investigation, with the consent of the family.

To date we have successfully run the full "Certificate" course as well as a residential CPD practical PMCT skills course. We now move onto the Diploma and MSc courses. The courses have attracted medical consultant and trainee level students from radiology and forensic pathology as well as radiographers, APT's (mortuary technicians) and anthropologists from all over the world.

These are the first multi-professional courses of their kind to be launched in the UK. We would wish to share our experience of their development and delivery with ISFRI.

Keywords: Leicester, post graduate education, certificate, diploma, MSc, CPD, post mortem radiology, imaging, natural death, unnatural death, forensic

Conflict of Interest: The host organisation (University of Leicester) has a commercial interest in these courses. The authors do not profit individually from these courses.

Very Affordable Immersion Pump for Post Mortem CT Angiography in Forensic Pathology: First 10 Cases

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About ten years after roller pumps were introduced for forensic post mortem CT angiography, it remains an open question why that relatively expensive pump mechanism (costing around 1000 USD for a used old heart lung machine to 80 000 USD for dedicated top of the line post mortem equipment) is actually necessary for post mortem CT angiography (PMCTA). Roller pumps make sense for non-Newtonian fluids like blood, where also mechanical hemolysis is a factor. In PMCTA, however watery or oily liquid is pumped into the vascular system of a body. After we established in a feasibility study that a simple immersion pump (priced around 15-20 USD) can be calibrated to obtain a linear voltage - flowrate relationship for the contrast agent solution used, and that vascular filling compared to a roller pump is basically the same, we present the results of the first eight cases in this presentation.

Immersion pump (IP): a Barwig model 0444 pump (max. 10L/min) was used (required PMCTA flow rate 0,2 - 0,8L/min) (cost around 16-20 EUR, power supply from 20 EUR upwards). Roller pump / heart lung machine (HLM): Stoeckert Shiley heart lung machine (max. 10L/min) was employed. Cases: eight cases from forensic pathology caseload were selected where PMCTA was seen as relevant and examined with the IP. Eight controls examined with the HLM. were used as comparison. Both arterial and venous sides were filled from a femoral access. PMCT / PMCTA: Dual source / energy CT scanner (Somatom Flash Definition, Siemens, Germany) was used (100 kVp tube voltage, automatic dose modulation). Reconstructions were obtained on Siemens syngo.via software.

Vascular filling was compared related to large vessels, coronary arteries, neck and head arteries, extremity arteries and on the same level, veins. Figure (IP: immersion pump; HLM: heart lung machine). Results were the same when access lines were reliably placed and vessels did not contain gas. Reduced filling was observed in case 3 (IP) based on gas due to post mortem decomposition and a leaking arterial access possibly due to the same reason. Tube handling was problematic at first but greatly supported by adding custom 3D printed support structures.

The good results are explained by the fact that the fluid being pumped is efficiently pumped by immersion or rotary pumps, so in fact a physical benefit a roller pumps may have for pumping non-Newtonian fluids simply does not seem to play out for this application.

To be able to perform a post mortem CT angiography with very affordable equipment with the same quality as high priced equipment means that a parametrized method can be validated and employed in far more institutes than when very expensive equipment is used.

Keywords: Virtopsy, post mortem CT scanning, forensic imaging, post mortem CT angiography

Visualization strategies in forensic imaging & Virtopsy: recommendations based on semiotic analysis

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Semiotic analysis is the search for hidden, unconscious or obscure patterns, symbols and meanings in what appear to be openly accessible images. With the question of what semiotic analysis could add to Virtopsy imagery, we approached the Department Knowledge Visualization at Zurich University of the Arts (ZHdK) and sought cooperation with the result that Eloisa Aldomar now finished a first part of her Bachelor degree on that subject. With that, we present the first results of this research cooperation.

Two cases - an accidental blunt trauma injury to the head with fracture and lethal subdural hemorrhage and a suicidal pistol head shot - were selected. The wide choice of visualization options when visualizing 3D data forces the expert to reflect on both preattentive and attentive processing mediated by qualities of the imagery created and presented. Preattentive processing is conveyed by implicit visual control codes that contain positioning, amount of detail, contrast, color, transparency or saturation. Attentive processing is directed by explicit use of metagraphic symbols, labels and captions. Relevance of image parts is given to focus objects, focus near objects and contextual visuals to convey anatomical orientation whereas decontextual objects may even approach irrelevance in a strictly medicolegal context.

Based on a semiotic analysis of a range of 15 single image variations derived from the two selected cases, a number of statements can be made. Image labels should not cover visual image content. Using single letters or digits makes it easier to place them without covering visual relevance. Arrows and labels should not impede a natural image reading direction usually from left to right. Parallel or orthogonal projections allow to easily convey scale whereas perspective distortion conveys "true" 3D. Relational information to identify cut planes or slices relative to overall anatomy may be important. Color may add coded similarity; it may visualize radiological or anatomical conventions and add structure to a visual object. As post mortem computed tomography is not a light based method, using colors wisely such may be a relevant issue. Furthermore, 3D visualization allows the combination of color and opacity to visualize depth and virtual lighting.

Our conference paper will give general recommendations for software settings and visual image presentation design and illustrate these issues, which is relevant in order to understand the points being made.

Using methods of visual design, the Virtopsy approach gains traction along an axis of implementing a new visual language. The details of this are up for negotiation, and there, mechanisms of persuasion and neurological, perceptual as well as psychological mechanisms play a role. While a more natural science approach may be to measure or to compare, visual design is a different type of science.

Keywords: Virtopsy, post mortem CT scanning, forensic imaging, visual design

Interactive Crime Scene Visualisation – The Forensic Holodeck

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3D scanning of collisions, victims or objects is common tool in forensic reconstructions. However, visualisation of a 3D reconstruction is often limited to 2D screens or print from defined points of view. Virtual Reality is a novel approach to enable visualisations of reconstructions in real 3D.

After acquisition of the 3D data and subsequent reconstruction of the scene, the data was visualised using the HTC Vive (HTC Corporation, New Taipei City, Taiwan) and a customized version of the software Destinations (Valve Corporation, Bellevue, Washington, USA), which focuses on the visualisation of photogrammetric data using computer gaming methods.

We present several applications for the use of virtual reality in forensics.

The use of virtual reality techniques allows not only the visualisation of 3D data but also interaction with objects as for example switching between scenes, changing the position, scale, colour of 3D objects or even animation of objects and scenes. A clear advantage of visualisation of 3D data in 3D is that the point of view can be defined by the viewer themselves enabling a better understanding of a scene. Additionally, by interactively highlighting objects it becomes even easier to understand links and relationships between these. The requirement of additional hardware such as the VR kit and powerful computer for the graphics calculations are a comparably small disadvantage. Virtual reality might become an important tool for future crime scene investigations, their understanding and legal judgement.

Keywords: Virtual Reality, Incident Reconstruction, Forensic Imaging

The Use of Diagnostic Imaging in Forensic Veterinary Pathology

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Demonstrate the application of diagnostic imaging techniques in the emerging field of forensic veterinary pathology and science.

Post mortem computed tomography (CT) and 3D reconstruction was performed on animals submitted for forensic post mortem examination. These images were compared with the findings and photographic images from the post mortem examination (necropsy). The cases presented in this presentation include four dogs with ballistic trauma, and a cat with blunt force trauma submitted by law enforcement agencies in the United Kingdom.

The post mortem CT images obtained aided interpretation and presentation of ballistic wounds in a case of double homicide involving four dogs. The post mortem CT images of the cat were central to characterisation of the injuries sustained in a case of suspected blunt force trauma, and their presentation to the court.

Post mortem computed tomography with 3D reconstruction is a useful technique when used alongside forensic post mortem examination of animals, particularly in cases of trauma. Images obtained from CT provide a tool for presenting wounds clearly and without distraction in the courtroom, in highly emotive cases involving animals.

The use of established medicolegal imaging techniques in the emerging field of forensic veterinary pathology highlights the possibility of collaborative efforts and knowledge-sharing. Expanding the use of imaging technologies across the two fields could lead to a 'One Health' approach to forensic imaging.

Keywords: Veterinary pathology, necropsy, computed tomography, One Health

Relaxation time of the skeletal muscles in postmortem MR imaging of adult humans

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To measure T1 and T2 values of the skeletal muscle with postmortem MR imaging (PMMRI) of deceased adult humans in vivo.

PMMRI was performed on 26 deceased adults (average age: 56.3 years; postmortem interval: 30.8 hours; rectal temperature immediately after PMMRI: 17.0°C). T1 and T2 values of bilateral erector-spinal muscles were measured, and compared with the skeletal muscle data of living humans. The relationship between relaxation times, rectal temperature, and postmortem interval were analyzed.

Compared with living humans, T1-values of PMMRI significantly shortened and T2-values significantly prolonged in the right and left erector-spinal muscles ($P < 0.05$). Positive correlations were found between rectal temperature and T1 values (right : $r = 0.41$; left : $r = 0.61$; $P < 0.05$) but not with T2 values (right : $r = 0.10$; left : $r = -0.01$; $P > 0.05$). T1 values of the left erector-spinal muscles showed a negative correlation with postmortem interval ($r = -0.42$, $P < 0.05$).

In an ordinary temperature range of deceased bodies, low body temperature contributes to shorten T1 and T2 values of water and fat, and T2-values of mineral components. After death, lactate generation occurs, which causes pH reduction in the body, possibly leading to prolongation of T2-values. These phenomena are considered the causes for our PMMRI results.

In PMMRI of the skeletal muscles, T1-values are shortened due to body temperature reduction, and T2-values are prolonged due to pH reduction.

Keywords: skeletal muscle, in vivo, body temperature, T1 and T2 values, postmortem magnetic resonance imaging

The influence of motion artefacts on magnetic resonance imaging of the clavicles for age estimation

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To determine the influence of motion artefacts on developmental stage allocation to the sternal end of both clavicles on MRI.

Eighteen healthy Caucasian volunteers between 14 and 30 years of age were prospectively included. One rest state scan and five intentional motion scans were conducted using 3T MRI. For every motion scan a rest state matched control scan was included, based on the developmental stages of the clavicles (Kreitner 1998). Since in every motion participant one rest state scan was conducted, an additional 72 rest state scans were selected from the study sample of Hillewig et al. (2013) and from an ongoing study at our institute. Six observers interpreted the anonymised images individually. Afterwards a consensus stage was allocated.

Although rest state scans were more often assessable than motion scans (71% versus 43%, $P < 0.001$), rest state scans were not more often correctly classified (55% versus 63%, $P = 0.55$). Moreover, reproducibility of staging was found to be unacceptably low, even based on rest state scans (Krippendorff's $\alpha = 0.21$).

The low inter-observer agreement could be explained by (1) breathing artefacts impeding staging even in rest state scans and (2) confusing stages I and IV, which occurred in both rest state scans and motion scans. Restricting developmental classification of the clavicles to a two-stage system (i.e. unfused vs. fully fused) might enhance reproducibility.

Evaluating clavicle development on MRI for forensic age estimation should be based on a restricted number of stages in order to be reliable.

Keywords:

Magnetic resonance imaging

Age estimation

Motion artefacts

Clavicle

Automated Multi-Factorial Age Estimation from Skeletal and Dental MRI Volumes based on Deep Learning

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To investigate deep neural networks for automatic chronological age estimation of adolescents given skeletal and dental volumetric MRI data.

MRI volumes of left hand, clavicle bone and wisdom teeth from N=103 volunteers were acquired. Known chronological age of volunteers was used for training two deep convolutional neural network architectures. The first network was trained entirely from chronological age, while the second network was pre-trained using expert provided biological age estimates and finally fine-tuned with chronological age. Age estimation errors in the form of absolute deviation from the ground truth chronological age were computed in a three-fold cross-validation.

Age estimation results on our data set of 103 volunteers between 13 and 25 years were 1.3 ± 1.13 years for the first network architecture, and 1.14 ± 0.96 years for the pre-trained architecture. When using age estimates for classifying majority age, we found a false negative rate of 6.8% and a false positive rate of 11.4%.

Our results indicate that an automatic way of assessing unknown age in adolescents is feasible from MRI volumes with an absolute error around one year. While the number of studied volunteers is still too low to generalize well to a larger population, this result is promising for further developments. In future work we will focus our attention on the false positive cases, since currently five out of 44 minors were incorrectly classified as above majority age.

While our results for the first time successfully show MRI based fully automatic multi-factorial age estimation, further work is needed to study misclassifications of minors being assessed as adults.

Keywords: Forensic age estimation; Multi-factorial; MRI; deep learning;

MR Spectroscopy in traumatic death: preliminary results

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Evaluation of postmortem MR spectroscopy (MRS) in brain of traumatic forensic cases
Method and material

Cerebral MRI examinations are routinely performed in our medicolegal institute. When feasible, MRS sequences were applied on two cerebral locations: brainstem and parietal lobe. 18 traumatic cases and 19 non traumatic cases were included. Postmortem interval and rectal temperature were measured.

For technical reasons, rectal temperature could not be measured in 8 cases. A spectroscopic profile was established for every case, by calculating metabolite peaks and ratios. The N-Acetyl-Aspartate (NAA) peak and NAA/Creatine (Cr) ratio decreased in almost half of cases. The Choline/Creatine (Cho/Cr) ratio widely varied in range and was reversed in 12 cases. The lactate peak was reversed in almost every cases with a double peak.

Brain MRS allows analysis of the chemical and metabolites composition of the brain. Nowadays, it is routinely used in many clinical applications. As far as we know, there is no published investigation concerning MRS in traumatic postmortem brain. We found out that the N-Acetyl-Aspartate was decreased, due to loss of neuronal wholeness. Regarding the Cho/Cr rate, it was reversed in 12 cases, probably related to an ischemic phenomenon. Lactate and lipide-lactate peaks were also detected.

This is the first time a MR spectroscopy investigation was performed in postmortem traumatic and non traumatic cases. Our preliminary results suggests that it should be used in evaluating traumatic brain injuries, when correlated to postmortem intervall and rectal temperature measurement.

Keywords: Postmortem, brain, trauma, MR spectroscopy.

Developing an approach to post-mortem MR angiography (PMMRA): Investigation of vascular retention of perfusates in ex situ porcine hearts

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To determine the vascular retention of liquids suitable for PMMRA and to examine their contrast with cardiovascular tissue.

Four ex situ porcine hearts were examined at 3T (23°C). One of four liquids (paraffin oil, Gadovist[®]-doped physiological solution, glycerol, PEG200) was manually injected into the left anterior descending (LAD) artery. A T1w 3D spoiled GRE sequence was used to image vascular structure. Images were obtained prior to injection, immediately following injection, and approximately one and 12 hours after injection.

All investigated perfusates appeared hyperintense on T1w images. Immediately following perfusate injection, images showed that paraffin oil, PEG200 and glycerol were retained within the LAD artery, while the Gadovist[®] solution was immediately distributed into smaller vessels/surrounding tissue. Images obtained after one hour demonstrated that paraffin oil remained within the LAD artery, while glycerol and PEG200 were no longer visible. Images acquired after 12 hours demonstrated no further significant changes.

Results indicated that both the viscosity of the substance and its chemical nature play an important role in post-mortem vascular retention. Rapid diffusion of the Gadovist[®]-solution was likely due to its extremely low viscosity and hydrophilic nature. The two hygroscopic solutions (PEG200, glycerol) are thought to have absorbed water from surrounding tissue leading to dilution and invisibility on the images within one hour. Vascular retention of paraffin oil mirrored the behaviour of the well-described paraffin oil/Angiofil[®] solution used in certain PMCTA applications.

Conclusion Paraffin oil was the preferred liquid for a clear, stable visualisation of the vascular structure in MRI for at least 12 hours.

Keywords: Perfusate; MRI; vascular retention; angiography; cardiac

Postmortem imaging as a standard in evaluation of sharp force trauma – overview of recent cases

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To deliver important evidence for forensic medical evaluation of the course of the critical event in sharp force trauma cases: pattern of injuries, including visualization of the injury track.

In all cases of sharp force trauma as a standard, post-mortem computed tomography (PMCT) and PMCT – Angiography (PMCTA) were performed using Somatom Emotion (Siemens AG, Germany), kVp 130, mAs 50 and 240, reconstructed slice thickness 0.75 and 1.5, collimation 16×0.6, and pitch 0.85 and 0.55. Contrast medium was administered to femoral vessels - 6 % paraffin oil solution of Angiofil® (Fumedica AG, Muri, Switzerland). The results were evaluated using the open source Digital Imaging and Communication (DICOM) viewer, OsiriX (Pixmeo SARL, Switzerland, version 5.0.2), including the analysis of two-dimensional (2D) slices, multiplanar reformatted (MPR) images and formation of three-dimensional (3D) images by volume-rendered reconstructions.

The authors present 2D and 3D images derived from selected recent cases of stab wounds showing the reconstruction of the injury track due to air spaces inside soft tissues, particles of broken bones, and focal contrast medium extravasations.

Presented cases may prove that both PMCT and PMCTA are important in modern evaluation of sharp force injury cases. While postmortem imaging is applied it gives the opportunity to present the reconstruction of the injury path in the way which seems to be quite easy to understand as well as without appalling images of conventional autopsy examination.

Conventional autopsy examination strengthened by postmortem imaging may be treated as gold standard in sharp force trauma cases.

Keywords: sharp force trauma, reconstruction of the injury track, postmortem imaging, PMCT, PMCTA

Pseudo Pneumatosis Intestinalis Sign; Postmortem CT depicted 'Taenia saginata (Parasite)' in a young-Thai-man's intestine

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Case presentation

29-year-old Thai man was found dead at his home in Japan by his partner who lived together. She called ambulance car and he was delivered to the emergency department of a hospital. Resuscitation had been tried about one hour but couldn't succeed and confirmed his death. He had been claiming lack of appetite and fatigueness from 3 days before his death. There was no specific past history. He entered Japan 4 months before his death and was staying in Japan illegally with his partner after his Visa was expired.

Postmortem CT Findings

- Inside intestine's wall, small nodular and linear gas was depicted. When seen on a lung window, the gas appearance looks like the pattern of which is seen on 'Pneumatosis intestinalis'
- There was no fatal hemorrhagic lesions and traumatic lesions.
- On bilateral lungs, consolidation with air bronchogram focused on central area was depicted

Autopsy Findings

- There was 'Taenia saginata' inside intestine from 4.5m point from terminal ileum. The length was about 4.5 m long and about 0.1cm width.
- Pulmonary edema was found.
- There was no other specific findings.

Toxicological and other examinations

There was no abnormalities.

We presented a case with PMCT image of Taenia saginata in young-Thai-man's intestine. By noticing the unique findings, we could facilitate the detailed investigation at autopsy and it could deepen the analysis of the cause of death.

Key words: Postmortem CT, parasite, intestine, Pneumatosis intestinalis

Non-invasive ethanol quantification in human bodies by in situ magnetic resonance spectroscopy

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The aim of this study was to reliably determine ethanol concentrations in human bodies with magnetic resonance spectroscopy (MRS)

15 adult human bodies with uninjured brain and skull underwent postmortem MRS. The ethanol concentration was determined with MRS in the cerebrospinal fluid (CSF) of the left lateral ventricle. To allow a clear separation of the ethanol and the lactate signal in the spectra, non-water-suppressed ¹H MRS with the metabolite cycling technique was implemented for postmortem in situ measurements.

The detected ethanol signals were referenced to the pure water signal measured in a separate scan in a spherical phantom to derive ethanol concentrations expressed in g/kg.

The MRS results were compared to the blood alcohol concentrations (BAC) measured in femoral blood.

In 8 of the 15 bodies, a BAC above zero was measured. In 7 of these 8 bodies it was possible to detect ethanol in the CSF with MRS. Only in the case of a low BAC of 0.03 g/kg, ethanol could not be detected with MRS.

The absolute difference between the ethanol concentration measured with MRS and the BAC ranges from 0.02 g/kg (6 % of the BAC) to 0.4 g/kg (31 %). The mean absolute difference is 0.12 g/kg. A significant regression equation ($MRS_ethanol=0.997*BAC+0.0$) was found ($p<.0001$, $R^2=0.922$).

This work demonstrates the feasibility of measuring ethanol concentrations non-invasively and reliably with MRS in human bodies. Deviations from the BAC are partially explained by the only approximately corrected relaxation attenuation of the ethanol signal.

Keywords:

- Magnetic resonance spectroscopy
- Alcohol
- Ethanol
- Postmortem
- Quantification

Notes

Notes

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